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The Outlook.

The outlook for engineering works during 1905 is decidedly encouraging. The past year has seen the completion of a number of great undertakings dependent mainly on engineering ability, and their success has materially raised the position of engineers in the public eye. The subway in New York and the tunnel under Boston harbor have been completed as designed, and have demonstrated the ability of competent engineers to foresee and provide against all serious difficulties in work of this character. The subaqueous tunnels at New York are progressing so smoothly that nobody hears about them. The great dam in the Croton valley is being pushed at a rate which makes previous records of the sort look quite feeble. The reconstruction of Baltimore is taking place with a rapidity that is astonishing, and in a manner that is a matter of gratification to those who aspire to see American cities well built. Among railways the easterly march toward the seacoast of the Gould system was a striking feature of the past year, although it has been overshadowed in the daily press by the terminal improvements at New York of the Pennsylvania and the New York Central systems. In the field of municipal engineering the noteworthy feature is the growing tendency to submit difficult problems to consulting experts. It was believed only a few years ago that municipal engineering was drawing to itself so many competent men that the consulting specialist would find himself without clients. This has proved erroneous, however, and the higher the grade of work done regularly in the offices of the cities, the more desirous are municipal officers of securing the best advice on all difficult problems. Speaking generally, the past year has been one which has been full of success for the engineer, and he is therefore warranted in looking forward to his full share of profitable work in the future.

It will be very strange if 1905 does not prove a year of general success. Reports from the representatives of this journal in all parts of the country indicate that enterprises which have been in abeyance for some time are now being taken up, and many of them will probably be put under construction at the beginning of the working season. The condition of the shops and mills of the country is very satisfactory, as a rule, and the only cloud on the sky is the possibility of more labor troubles. With a return of business confidence there is always an inclination on the part of so-called labor leaders to make unreasonable demands for largely increased wages. They mistake the approach of greater prosperity for its actual presence and strike before the iron is hot. It is therefore incumbent on engineers, whose duties make them unusually well acquainted with the conditions of undertakings requiring great expenditures for labor and materials, to act conservatively at such a time as this. The prospects for better business are good, but they are only prospects as yet, and unless conservatism

remains the ruling principle of all business affairs, the men who must furnish the capital for the great works now being discussed will not care to advance the necessary funds.

Safety on Railways.

It is perhaps not surprising that most of the loud debating of the general subject of safety in railway travel is done just at present by those whose reputations as railway experts are not high. It generally happens that the more complicated the conditions influencing the solution of such a problem, the more numerous and less competent are the self-appointed critics. Safety of travel on railways cannot be made a matter of automatic safety appliances, although the latter are of great service, and the present cry for block signals as the sole solution of the question is based on lack of complete knowledge. In order that the readers of The Engineering Record may know definitely how this matter is regarded by many railway men of the ripest experience and highest professional standing, the following comments by the president of the Wabash Railroad Co., Mr. Joseph Ramsey, Jr., M. Am. Soc. C. E., are presented in this place.

It will be admitted by all railroad operatives that a strict compliance with the train and block signal rules on the part of engineers, trainmen, block signal operators and others connected with train movements would absolutely prevent collisions of all kinds. The more improved appliances a railroad company puts on its lines for the safety of its trains—such as block signals, whether automatic or otherwise, interlocking plants at crossings, etc.—the more careless, apparently, the trainmen become in obeying the rules for the protection of their trains. The minute a train runs inside a block section, the trainmen feel that they are protected against any rear end collisions and that there is no necessity for flagging on their part, as the block signal in the rear will protect them until they get out of the block. Should the block signal operator make a mistake and let a train into the block when it should be kept out, the neglect to flag on the part of the preceding train results, as a rule, in a bad accident.

We endeavor to enforce our rules strictly, and trainmen, block operators and others are instructed that if a train is delayed through compliance with the rules, that neither the trainmen nor the operator are at fault, and that they are expected to comply with the rules regardless of resultant delays. If we had laws in this country similar to those of some foreign countries, which hold the employee, be he officer or trainman, legally responsible for violations of rules and for accidents resulting therefrom, it would be the best safety appliance law which could be passed, and if the District Attorney of any district were required by law to take up such cases, the effect would be to prevent a large number of accidents which are now occurring

solely through carelessness and neglect of rules.

As block signals tend to carelessness in, and violation of, the flagging rules, so do some of the safety appliances which have been put on all railroad equipment under the Interstate Commerce Act tend to make some classes of railroad employes more negligent and careless and less skilled in their work than under the old methods of railroading. Switch and yard men are much more careless in switching cars in the yards and in making up trains than they used to be when they had to go between the cars to make the coupling, and freight trainmen are more negligent and careless of being at their proper posts of duty on trains, now that the braking of trains is controlled by the engineer, than they used to be when they had to handle the trains with hand brakes, and engineers are more careless and reckless and take greater chances in the speed of their trains and in approaching terminals and crossings, now that they have air brakes, than they used to be under the old hand braking regime, and the result, frequently, is that if the air brakes fail to stop the train as quickly as the engineer anticipated, he will pitch into another train at a crossing or into some waiting train at some passing point or station.

I do not wish to be understood as being opposed to all these safety devices, block signals, interlocking plants, air brakes, automatic couplers, etc.; on the contrary, I am heartily in favor of them, and the Wabash is thoroughly equipped with all these devices, all main lines of the Wabash being block-signaled, but they certainly do tend to carelessness on the part of trainmen and others in complying with other safety rules, and in making them, to a certain extent, less skilled railroad men than the old railroaders used to be. When a conductor, brakeman and engineer worked under their rights only, and knew that unless they protected themselves and their train, there was no other protection, they were more apt to flag properly and take no chances than the trainmen who think they are amply protected by block signals, etc.

If every trainman, block signal operator or other employe whose duty connects him with train service, or whose violation of a rule might result in an accident, would impress upon his mind that in the event of a violation of a rule and the taking of chances resulting in the death of any one, he was guilty of murder, it seems to me he would be more inclined to comply with the rules even if he "broke the owner" or caused some negligent or inefficient officer to lose his job. No efficient railroad officer will wink at the violation of train and block signal rules.

J. RAMSEY, JR.

The Isthmian Canal Situation.

About eight months ago the New Panama Canal Company transferred to the United States the title to all its property rights and franchises on the Isthmus of Panama, besides some minor property, consisting mostly of maps and documents, in Paris. The Isthmian Canal Commission, therefore, has had responsible charge of the canal property on the Isthmus of Panama the same length of time. The transfer of property was made in the early part of the month of May, 1904. Within a month of that time the Commission had made substantial progress in the organization of the first five engineering parties for work on the Isthmus, and within two months of the time of transfer a large portion of those five engineering parties was at work in the field and all had sailed from the city of New York. The total engineering force thus organized and sent to the Isthmus was, we are informed, nearly

150 men. Also, within six weeks of the transfer of the property the Commission had appointed its chief engineer, Mr. John F. Wallace, who was on the Isthmus, discharging his duties, within about two months of the assumption of responsible charge by the Commission.

Shortly after the organization and procedure to the Isthmus of the five principal engineering parties, a sixth smaller party for special work in the Culebra cut was also organized and sent there, where it has since been actively at work. This active assumption and performance of its duties by the Commission was certainly prompt and energetic, but during the past month the daily press has frequently printed severe criticisms of the work of the Commission, asserting sometimes that it is unwieldy, again that there is friction among its members, that its responsibilities are too much divided, and, finally, that it ought to spend its time on the Isthmus, where it actually would have no continuous functions except as it might drift into constant interference with the work of the chief engineer for lack of other material exercise of its powers. The full Commission consists of seven members, but in consequence of the resignation of Col. Hecker in November there are now six members only, and the Congressional critics, it is understood from statements in the daily press, desire to reduce the number to three and make them of secondary authority to the chief engineer, with Panama or Ancon as their headquarters. The preceding observations faithfully represent the gist of the criticisms so far as they have any definition at all. At first sight it seems a little strange that a body of men of high character, the majority of whom have each had more than a quarter of a century of active administrative experience in the larger engineering works of the country, should begin their work so well and in the short space of eight months drift into inefficiency and inertness.

The source of these criticisms seems to be the Interstate and Foreign Commerce Committee of the House of Representatives, of which Colonel Hepburn, of Iowa, is the chairman. It may or may not be significant that Colonel Hepburn, a man not altogether free from strong prejudices, was a most determined and obstinate advocate of the Nicaragua route without regard to the merits of the question, and has, in season and out of season, fought with bitterness all measures looking to the selection of the Panama route, but it is well enough to note that feature of the case in passing. In the early part of November, immediately after the presidential election, Colonel Hepburn's committee took their wives and relatives on a government transport and at government expense proceeded to the Isthmus and remained there four days, possibly a few hours longer. In that short time this junketing expedition appears to have secured an astonishing amount of information, technical and otherwise, and to have formulated conclusions of positive character. Since the return of the committee and its many friends who accompanied it, the daily press, one might say, has teemed with criticisms of the progress made by the Commission, its constitution and its serious lack of accomplishing anything.

The Engineering Record has always taken much interest in the proposed construction of this great ship canal and, with the desire to get at the facts of the case, it has made efforts to secure reliable information as to the actual condition of the work performed by the Commission since its creation. It has also read carefully the printed copy of the evidence given by Mr. John F. Wallace, the chief engineer of

the Commission, before the Congressional committee during its four days' inspection of the work. Contrary to the grossly exaggerated and distorted reports of what Mr. Wallace said before the committee, his evidence actually shows that he spoke in the highest terms of the support which the Commission has given him since his assumption of his duties, of the completely cordial relations existing between the Commission and himself, and of the further significant fact that the Commission has repeatedly urged him to hasten his work of surveys and examinations now in progress so as to afford at the earliest possible date the requisite data for the solution of the main problems on which the construction work must be based.

As this journal learns the situation, all six of the engineering parties organized and at work on the Isthmus have prosecuted their individual operations with the utmost vigor and thoroughness and have accomplished an extraordinary amount of work for the short period which has elapsed since last June.

The party making the surveys and investigations near Colon for the deep channel leading to the canal and for the interior harbor at its entrance as well as for a modified alignment between Colon and Gatun has already completed its examinations to such an extent as to afford within a short time the data for the bulk of the work to be done in that vicinity. Indeed, it seems probable that within the next three months a large amount of this work will be in progress.

The second party in order from Colon has made extended surveys and examinations, including borings in the vicinity of a proposed dam across the Chagres River near Gatun and at one or two other possible sites a few miles further up the river, and for the proposed Tiger Hill alternative, which was so actively advocated by the late George S. Morison, a member of the former Commission. This work covers a large extent of territory and has also been prosecuted well toward its completion.

The third party, it appears, has confined its operations to a large amount of jet boring, surveys and other investigations required to determine the best dam site near Bohio and some possible modifications of alignment near that locality. This work has also been pushed with vigor and wise direction, so that a far more complete knowledge of the underlying bedrock in all the Bohio vicinity has been acquired than ever before. It is just such information as must be secured before a dam at Bohio can be intelligently or economically located if it should prove to be desirable to build such a structure.

The fourth party has also been obliged to cover a large amount of territory reaching from Gamboa, where the river Chagres in its downward course first intersects the canal line, to Alhajuela, some 12 miles upstream, and over the full width of the Cordillera, the southern limit of the Chagres basin, as well as the opposite ridge or divide, on the northerly side of the same basin. This party has already established the entire feasibility of the great Gamboa dam and has located, also, the best known tunnel line through the Cordillera to the southward for the diversion of the flood waters of the Chagres to the Pacific Ocean if it should be desired to employ such a feature of control of the Chagres floods. It has also located a line for a tunnel of about four miles through which the flood waters of the Chagres can be diverted toward the Caribbean Sea if it is desired to keep them out of the canal by such means. This work of reconnaissance and surveys, with the great mass of jet borings which have been made at the Gamboa dam site constitute a highly creditable amount of work for this party for

the length of time in which it has been accomplished.

The fifth engineering party, the smallest one of the entire number, has been rendering excellent service continuously at the great Culebra cut. It has devoted its efforts to such surveys and other examinations as are required to determine the advisability or inadvisability of modifications of the alignment through the continental divide in the vicinity of Culebra. It has, further, under the direction of the chief engineer, established field accounts for the reorganized force and refitted French machinery still employed in excavation at that point with signal success.

The sixth engineering party has charge of the duties of devising water-works and sewer systems for the cities of Panama and Colon. It has accomplished its work with such expedition and efficiency that the city of Panama will receive the first public water in its history probably some time next month, and its sewer system will be completed soon thereafter.

A department of materials and supplies has also been organized for the conservation and distribution of the enormous mass of plant and machinery left on the Isthmus by the old Panama Canal Co. and for a vast amount of other similar duties, such as receiving and caring for new supplies purchased from the United States and acting as a great depot and center of distribution of all materials, plant and supplies which will be needed hereafter in the work of construction. Further than this, a large sanitary force, including effective quarantine organizations at both Panama and Colon, has been organized. The duties of these sanitary and medical forces, including that of the great Ancon hospital, have been so ably and effectively performed that the mosquitoes on the canal zone, including Panama and Colon, have been largely exterminated and the entire Isthmus changed into a reasonably sanitary district even at the present time. This portion of the Commission's work is one of the most difficult and the degree of efficiency which has already been reached in its administration shows conclusively that the work has not only been well directed in all its details but most efficiently performed. While there have been five or six cases of yellow fever since the Commission first began its work, they were all sporadic in character, each having no connection with the others, and in no case has the infection spread.

These results, however, are not all, it appears, that the Commission has accomplished. The enormous quantity of machinery and material which must be purchased in this country required that a great office force, not only for the keeping of accounts and for the general administration of all its financial operations but also for the preparation of specifications, of advertisements for bidders and for the careful systematizing of the bids received and for the mass of details connected with such a purely commercial work, should be established and maintained at Washington. It is probable that the magnitude of this part of the Commission's work is not appreciated or realized by anyone who has not taken the pains to investigate it. The House Interstate and Foreign Commerce Committee should examine the Commission's organization in Washington and ascertain the amount of administrative work of a business character which the Commission is daily performing at its main offices. The many channels of communication between manufacturers and dealers in the country and the canal market, so to speak, must all center at Washington, and the resulting detail administrative work is of extraordinary magnitude.

It appears reasonably clear from this mere skeleton statement of the main features only of the work which the Commission has thus far organized and put in progress, that the engineering and administrative operations both on the Isthmus and at Washington have been conducted with energy and directness and, it is safe to state, with wisdom and a conscientious sense of the responsibility attached to the discharge of such great duties. A superficial examination only is sufficient to disclose the fact that the main business operations of the Commission must be conducted in this country and not on the Isthmus. While the Commission must be in constant touch with the actual operations of construction and must pass its judgment and put the seal of its approval upon every plan to be executed by the chief engineer, it would be the extreme of administration folly to spend even any considerable portion of its time as a body scrutinizing, criticizing and inevitably interfering with the daily operations of the chief engineer. Any such procedure would be about as sensible or judicious as a board of directors of a railroad in process of construction living daily along the line with the chief engineer and attempting to direct him in those functions where he should have free exercise of his judgment. The natural result in every event would be a quick and intolerable state of friction, leading to complete demoralization of the work of construction. No other course could lead so quickly to the complete dissipation of administrative efficiency. Whether the Commission or its committees should spend more or less time upon the Isthmus is a matter which should be left wholly to its discretion; that kind of responsibility can properly be lodged nowhere else.

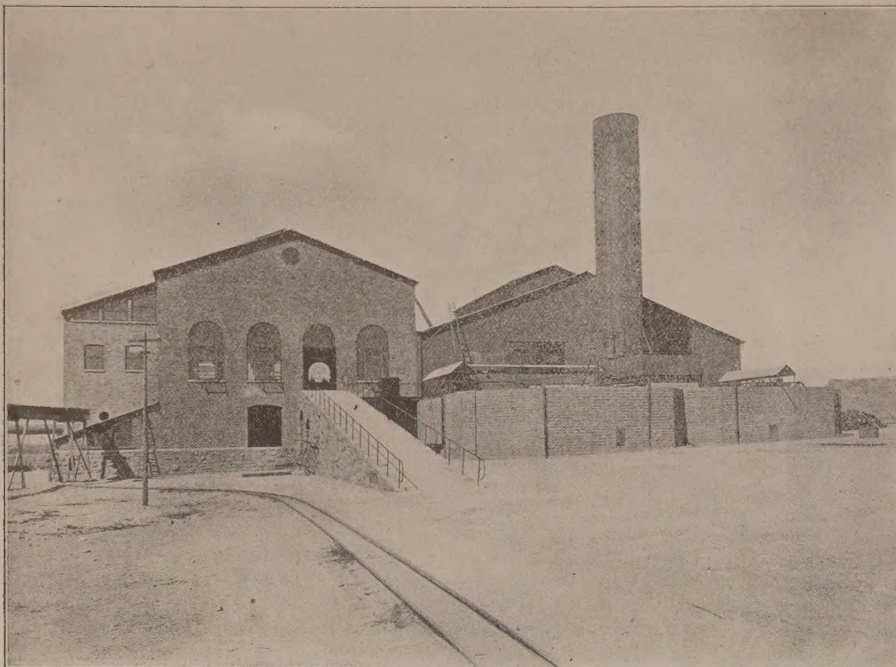
Anyone familiar with the inception of great engineering works can realize how imperatively necessary it is that ample time should be taken for full investigation and study before the adoption especially of the plans of any of the main features of the canal. The old Panama Canal Co., with De Lesseps at its head, adopted the other method and proceeded to the construction of the work first and the adoption of plans afterward. The result was one of the most stupendous pieces of bankruptcy and corruption that the world has ever known. In a work of such magnitude the Commission can most usefully spend from one to two years in study and preparation of its plans before work on the full scale is begun, as was so forcibly stated by the late George S. Morison.

At this writing there seems to be a specially wild outbreak of criticism from some of the great newspapers of the country in criticism of about everything which it is supposed the Commission both has done and failed to do, but, in many cases at least, it is plainly evident that the motive is chagrin at the adoption of the Panama route instead of the Nicaragua. It is a little too late to attempt to begot the public mind on this dead issue, however keen the personal disappointment may be, by the intemperate and unreasonable advocates of the Nicaragua route. Had the United States embarked upon the construction of the Nicaragua canal, the contingencies to be encountered and the amount of money to be spent before the completion of that work would be past all estimate. The engineering and other advantages of the Panama route are overwhelming, and the country is to be congratulated that its choice has been so wisely guided to the adoption of a route which is not only free from physical difficulties but which will involve the expenditure of an amount which can be reliably estimated and the end of which can be clearly seen.

If there is any one duty which the present Isthmian Canal Commission or any other commission owes to the country, it is the most careful deliberation in securing the most complete possible data and arriving at its final plans only after careful study by its chief engineer as well as by the Commission itself. The President has acted wisely in making the Commission as large as it is, and the Commission has acted efficiently and energetically in the great trust committed to it, and it may be said, with equal truth, that the chief engineer has simply discharged his proper duty under the Commission in, among other things, entering upon a thorough study of all those elements involved in a comparison of the sea level and lock canal plans. The President should steadily pursue the course which he has laid out for the construction of this work and yield nothing to the intemperate criticisms which have lately found their way so freely and so irresponsibly to public attention.

THE EAST BOSTON TUNNEL is now in public use, and for the sum of one cent in addition to the regular five-cent fare it is possible to ride from Boston proper, under water, to Noddle Island. The general design and methods of construction of this great work have been fully described in this journal, and in recording the beginning of its use on Dec. 30 it is only necessary to add that the history of the undertaking has been most creditable to the Commission, its chief engineer, and the contractors. The construction of a subway 1.4 miles long, including a 2,700-ft. subaqueous section, is a difficult feat, particularly in this case where the large cross-section, the extensive use of concrete, and the adoption of a peculiar type of roof shield introduced novel problems. The completed subaqueous tunnel is practically water-tight, the infiltration being but 8 gal. per minute, and readily handled by small electrically-driven pumps. Ventilation is afforded by a duct of 48 sq. ft. area, formed by a thin reinforced concrete diaphragm in the upper part of the tunnel. Electrically-driven fans at each end draw the air from the tunnel through openings in the diaphragm through the duct and force it out at ventilating chambers.

NUISANCES FROM POWER PLANTS in the residence districts of cities rarely occur, because such locations are not often chosen for stations. The Edison Electric Illuminating Co. of New York built a plant of this sort on West 26th St. in 1888, and some months ago the Appellate Division of the Supreme Court awarded the owner of an adjoining hotel damages against the company for maintaining a nuisance. It was claimed that the premises were injured by the soot and steam from the station and the guests were annoyed by noise and vibration. The case was decided against the company, which appealed from the verdict on the ground that the instructions of the trial judge to the jury did not properly state the rule for determining the amount of the damages. The two exceptions have been overruled by the Court of Appeals, 72 N. E. Rep. 243, as follows: "First—Plaintiff in his complaint alleged that defendant so operated its electric light plant as to discharge on plaintiff's hotel great quantities of soot and cinders, injuring the hotel and its furniture, and introduced evidence to sustain such allegations; held, that an instruction that the measure of damage was the actual diminution in rental value was properly refused. Second—Where there was evidence that the rent of the rooms in the hotel had greatly depreciated, an instruction that loss of income from business was not provable as an element of damage was properly refused."



Exterior View of the Central Power Station.

THE POWER PLANT OF THE DE BEERS CONSOLIDATED MINES, LTD.

A DESCRIPTION OF STEAM TURBINES AND ELECTRICAL APPARATUS AT THE DIAMOND FIELDS OF KIMBERLY, SOUTH AFRICA.

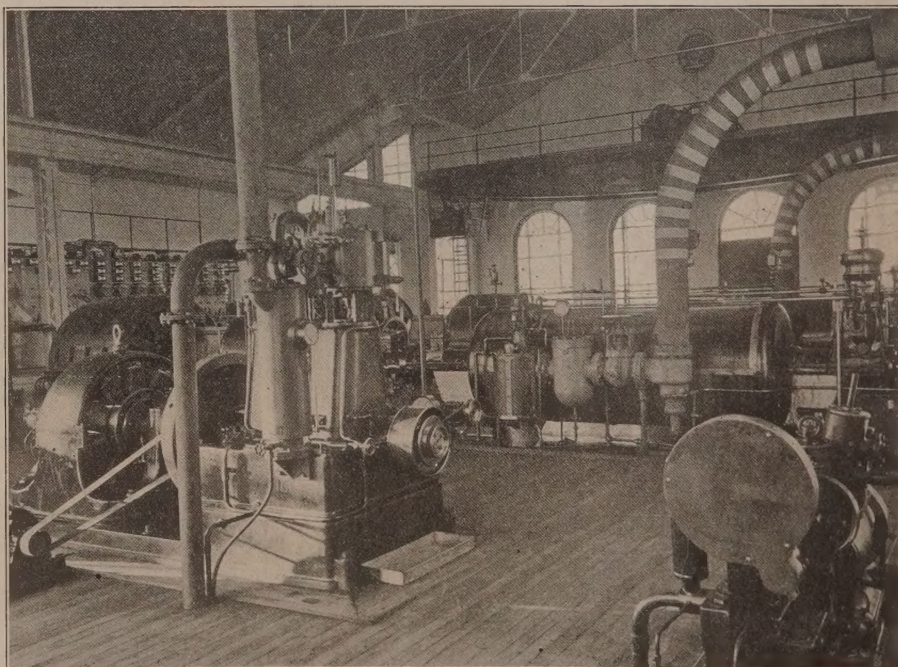
By Alpheus F. Williams, Acting General Manager, De Beers Consolidated Mines, Ltd.

The subject of steam turbines and steam turbine practice has occupied and is still occupying the attention of all engineers throughout the world, and this article is merely descriptive of a plant which was the second of its kind in South Africa, and also deals with some of the interesting uses to which the current generated is utilized. The writer would especially beg to point out, however, that as the plant referred to has not yet been sufficiently long in service to make possible any comparisons, as regards economy, with reciprocating engines, he proposes not to quote any figures relating thereto.

The outfit consists of two 1,250-kw. turbo-alternators, and the contractors for the work were the Westinghouse Electric & Manufacturing Co., Pittsburg. Very elaborate tests were carried out under the supervision of the late Professor Thurston before shipment from Pittsburg. Each set consists of one Westinghouse-Parsons steam turbine, direct-connected to and mounted upon the same shaft with a three-phase alternating current Westinghouse electric generator. Each set is capable of delivering continuously 1,000 kw. of useful energy, and has an overload capacity of 50 per cent. for short periods. The power is delivered in three-phase alternating currents 120 deg. apart, the periodicity of the alternators being 50 complete cycles per second. The mean electrical pressure between any two terminals of the generator is 5,000 volts. The speed of rotation of each set is 1,500 r.p.m.

Turbines.—The turbines are of the multiple expansion parallel flow type and consist of the two turbines arranged "tandem compound," with an intermediate reheater between them. The steam distribution is such that with full load each turbine develops approximately equal power. They are adapted for driving a direct-connected four-pole alternating-current generator, designed for 50 complete cycles per second at 1,500 r.p.m.

The approximate dimensions and weights are as follows: Length, exclusive of generator, 34 ft.; width, 9 ft.; height above floor line, 7 ft.; total weight, 130,000 lb.; heaviest piece, 45,000 lb.



Interior of Central Power Station.

The cylinders are of close-grained cast iron and designed so that the tensile stress shall at no time exceed 2,000 lb. per square inch. The shaft is of high quality mild steel having mounted thereon cast-steel rings for carrying the turbine blades. The maximum stress of the

shaft due to bending and twisting moments is designed so that it shall not exceed a fiber stress of 8,000 lb. per square inch. The turbine blades are of best mechanical construction and of such form and dimensions as to be most conducive to high economy.

The bearings are of best quality gun metal, and of ample surface to ensure running cool without undue wear. Bearings are also furnished for the generators, which are mounted within a rigid cast-iron pedestal, or bracket, forming an integral part with the turbine cylinder.

A steel coupling is provided for connecting high and low pressure turbine and generator shaft.

A sensitive governor is furnished for controlling the speed by varying the admission of steam, which is driven by the turbine by means of gearing. A safety mechanical governor is fitted to each turbine, which comes into action when the speed rises to a certain point, and is arranged to entirely cut off the supply of steam. The governor valve is of the balanced poppet valve type, made of bronze, and enclosed in steam chest.

An oil pump is provided and is driven by the turbine, for the continuous lubrication of all main bearings; also a reservoir for the reception of oil.

The throttle valve is equipped with small bypass for warming-up purposes. A steam strainer is fitted for preventing foreign substances from entering the turbine by means of the steam pipe.

The reheater is of steel, well lagged, having charcoal iron tubes, the steam to be reheated passing through the tubes, and is located below the bed-plate.

The bed-plate is made in sections and is of cast iron, and provided with location for generator and outboard bearings. It is also provided with upper slabs to receive the various feet, etc., of the turbine and generator.

Generators.—The generators are of the Westinghouse turbo type with rotating field, the rotating part being built upon an extension of the turbine shaft.

The armature has a three-phase winding for a normal output of 1,000 kw., viz.: 115 amperes

per terminal at 5,000 volts with non-inductive load.

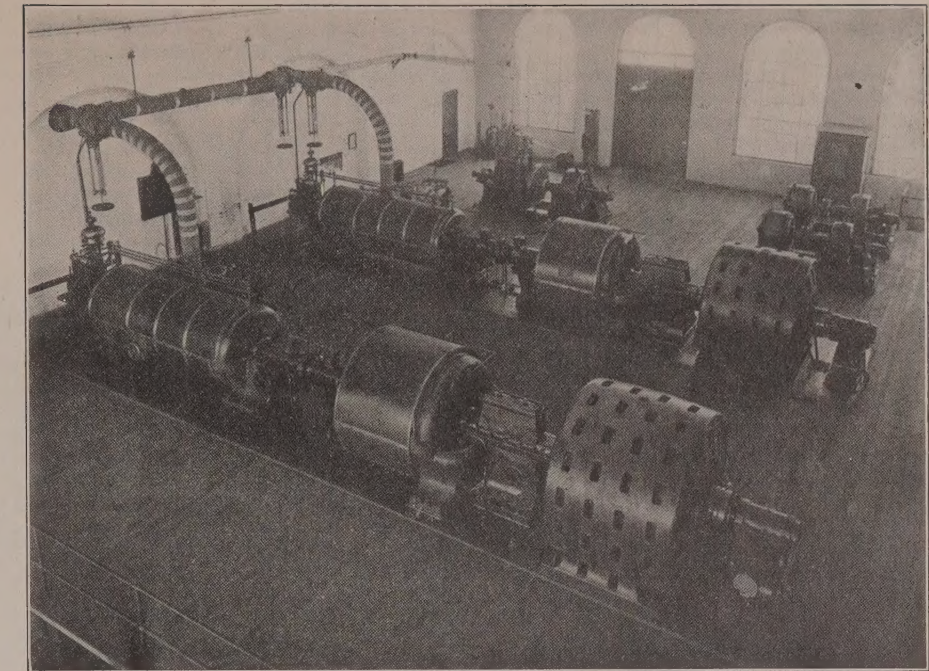
The machines have four poles and are adapted for operation at 1,500 r.p.m., giving 6,000 alternations per minute, i. e., 50 cycles per second.

They are separately excited. The separately excited fields require 120 amperes at 80 volts when the armature delivers its full rated current at 115 amperes per terminal at the normal e.m.f. of 5,000 volts at 100 per cent. power factor. The machines require 15 per cent. greater current when the armature delivers its full rated current at normal voltage at 90 per cent. power factor.

The regulation is as follows: A load of 115 amperes per terminal at 5,000 volts e.m.f. and at 100 per cent. power factor may be thrown off and the e.m.f. will rise approximately eight per cent. with constant speed and constant separate excitation. When carrying the rated current of 115 amperes at the normal e.m.f. of 5,000 volts at 90 per cent. power factor, the separately excited field current is 15 per cent. greater than when carrying the same armature current at 100 per cent. power factor.

With regard to temperature these machines operate for 24 hours at 5,000 volts and at 115 amperes per terminal at 85 to 100 per cent. power factor, and the rise in temperature in no part exceeds 40° Cent.; and at 25 per cent. greater current with the same power factor, for 24 hours, the rise in temperature does not exceed 55° Cent.

The fields are made of the best quality of cast steel, sound and free from blow holes. The pole pieces are of steel, the pole pieces and field winding being so proportioned as to reduce the armature reaction to a low limit. The field coils are wound with strap and arranged for good air circulation. The insulation of the field coils from the frame consists of several layers of fibrous material, and is substantial and permanent. The insulation of the coil was sub-



The One-Thousand-Kilowatt Turbines in the Central Station.

laminated core thus built up is held firmly in place between two end plates. The armature winding consists of wire-wound coils, formed and insulated before being placed in the slots. The coils are held in the slots by retaining wedges of hard fiber.

The insulation of the armature conductors consists of sheet material of high-insulating quality, applied in overlapping layers. This is held in place with tape, and the whole treated with a moisture and oil-proof compound. After completion the insulation of the armature wind-

large and open ventilating ducts are provided. The design of the rotating spider is so arranged as to set up a forced circulation of air through these ventilating spaces. Space is also left between the field coils, so that free circulation of air may be maintained while the machine is in operation. The end windings of the armatures are so arranged that the air will circulate freely among them, thus keeping the temperature very low.

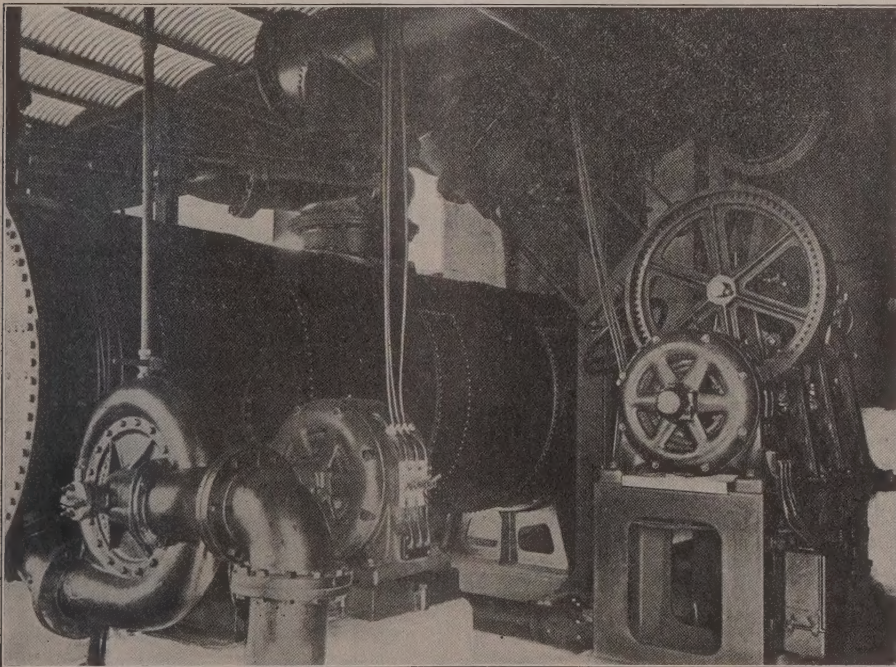
Each alternator is fitted with a high tension terminal board making connections with the leads from the main switchboard.

For exciting the fields of above generators there are installed two Westinghouse motor-generator exciter sets, each consisting of a 50-h.-p. 220-volt alternating-current motor mounted on a common base with and direct-connected by means of a flexible coupling to a 37.5-kw. 110-volt direct-current generator. These outfits run at a speed of 720 r.p.m. The current supplying these exciter sets comes from a bank of three 100-kw. oil-insulated self-cooling Westinghouse transformers, the primary of these being 5,000 volts, the secondary 220 volts.

The switchboard, consisting of six high-tension feeder panels, three high-tension machine panels, one high-tension station panel, and six low-tension local distribution panels, and which was supplied by the General Electric Co., takes care of these generators, exciter sets, transformers, and all the outgoing 5,000-volt, three-phase feeder circuits, together with the local power house, auxiliary motor and lighting circuits.

Auxiliary Belliss-Westinghouse Set.—This consists of one 125-h.-p. Belliss engine and one 75-kw. Westinghouse alternator. The engine is capable of developing 125 h.-p. when running at a speed of 600 r.p.m. and supplied with steam at the engine stop valve at a pressure of 140 lb. per square inch and working non-condensing. The approximate steam consumption per horsepower per hour with dry steam at 140 lb. at the engine stop valve, non-condensing, is: Full load, 26½ lb.; three-quarter load, 28½ lb.; half load, 31½ lb.

The cylinders are of hard, close-grained cast iron, well lagged with non-conductive material, covered in with planished steel sheet. Top and bottom covers are well secured by studs closely pitched.



Condensers in the Central Power Station.

jected to a puncture test of 10,000 volts alternating e.m.f.

The armatures are of the slotted drum type. The core is built of laminated steel of high magnetic quality, the laminations being pressed upon the cast-iron frame. The sheets are of steel, dove-tailed accurately to the frame. The

ing from the core was subjected to a puncture test of 15,000 volts alternating e.m.f.

The collectors are made of special brass, and of ample size for the maximum current to be carried.

Ventilation is arranged as follows: Throughout the armature, spider, core and windings,

The slide valves are of the piston type, and so arranged as to secure steam tightness and freedom in working.

The bed-plate is a massive iron casting, well ribbed, and forming at one end a well for the reception of the oil pump and strainer, and large enough to contain sufficient oil for running the engine. The upper part is planed and studded to receive the casing, and accurately bored for the reception of the main bearing shells. The underside has a large planed facing to support it on the foundations.

The crank shaft and connecting rods and all other forged parts are of the best quality mild open-hearth steel, machined down from heavy forgings. The cranks are machined all over, the webs being slotted from the solid. The piston and slide rods are of a special steel fitted into steel cross-heads, the guide shoes of cast iron having extra large surfaces for wear.

The bearings in general are lined with best anti-friction white metal, with specially large surfaces, suitable for continuous running at full power, and provided with means for adjustment for wear throughout.

The cross-head pins, and all working pins throughout, are of specially hard steel. The main bearings at both ends of the engine are fitted with an efficient guard to prevent oil escaping from the crank chamber.

The flywheel is cast iron, with the ordinary heavy rim truly turned and polished and of suitable weight to secure uniform rotation, the center of the wheel being faced to bolt up to the dynamo half-coupling.

The engine is fitted with a powerful centrifugal governor on the crank shaft, operating on the throttle valve and controlling the steady speed of the engine within three per cent. between full load and no load, and capable of adjustment while the engine is in full motion.

The engine in operation is of the standard pattern, made by Belliss & Morcom, Ltd., Birmingham, England, and similar to others supplied by them to different countries and governments. The object of this auxiliary set is a precautionary measure, as in case of the entire shut down of the power station it will supply current to operate the exciter motors for the main generators.

Motor Drives.—The various motors used in the power station itself, such as those for driving coal conveyors, circulating pumps, air pumps, feed pumps, stokers, coal breakers, etc., are operated from 220-volt three-phase alternating current supply.

There are two sets of three-throw motor-driven Edwards air pumps, each having three barrels 14 in. in diameter by 12 in. stroke, and designed to run at a speed of 150 r.p.m. There are two auxiliary pumps, double-acting, 4½ in. diameter by 6 in. stroke. They are fitted with gun metal throughout and are driven from crank pins in a disk fitted to the ends on the air pump crank-shafts at the opposite end to the motor. These pumps are capable of taking the water discharged from the air pumps and delivering it against a head of 25 ft. Each set of pumps is fitted with a motor pedestal designed to suit the motor, and bolted securely to the pump casing. The speed reduction gearing between the motor and the pumps consists in each case of one machine-cut steel spur wheel on the pump crank-shaft and a rawhide pinion on the motor spindle. These pumps were subjected to a hydraulic test pressure to 30 lb. per square inch. Each set of pumps is driven by one 20-h.-p., 220-volt, 50-cycle, three-phase motor running at 750 r.p.m., which were supplied by the General Electric Co.

Westinghouse alternating-current motors drive Blake & Knowles pumps, Fraser & Chalmers compressors, etc.

The Robins coal-conveying plant is driven by a 10-h.-p. General Electric alternating-current motor and has a 16-in. belt. The coal is passed through coal crushers operated by 20-h.-p. alternating-current motor, also supplied by the General Electric Co.

Boiler Plant.—There are at present installed eight Babcock & Wilcox boilers, each of 3,580 sq. ft. of heating surface, set in four batteries. The pressure is 150 lb. per square inch.

Eight superheaters having 339 sq. ft. of heating surface and capable of imparting about 75° Fahr. of superheat, are installed.

There are eight sets of chain grate stokers which have sufficient grate area to burn 1,200 lb. of coal per hour, with necessary hoppers and gearing.

The draft fans are three-quarter housing induced draft type, fitted with jacketed bearings. One is driven by a direct-connected 8x5½-in. double-enclosed engine running at a speed of 275 r.p.m.; and the other is a fan of similar dimensions driven by a 50-h.-p. General Electric alternating-current, 220-volt motor.

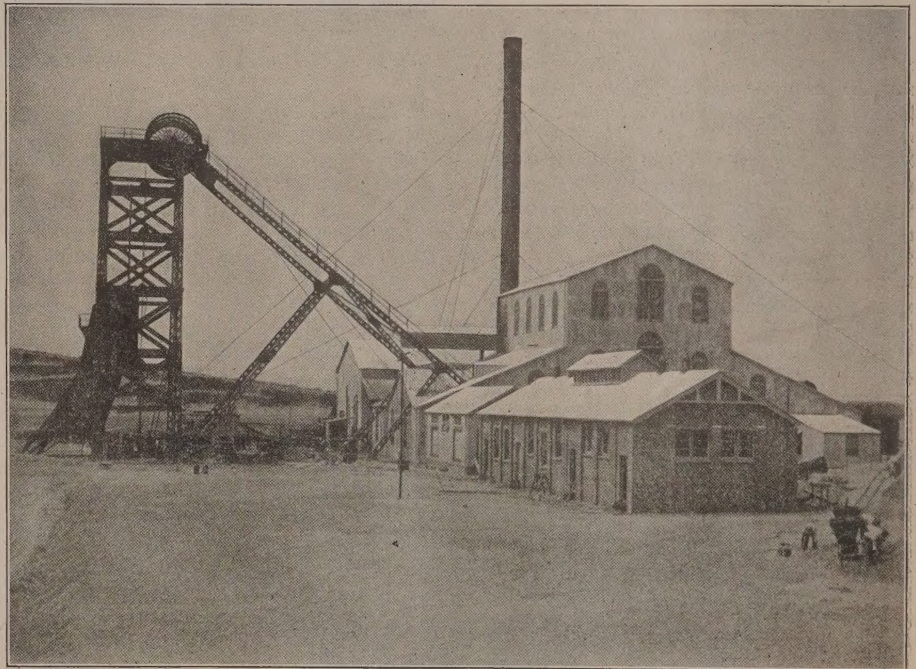
There are two Greens' economizers, each of three sections of 160 pipes each, with scrapers

pumps is 879 r.p.m. These are driven by General Electric 32-h.-p. 220-volt, alternating-current motors.

The electric crane has sufficient capacity to lift 15 tons and was built by Messrs. Vaughan & Sons, Manchester, England.

Transmission of Power.—Three-phase current at 5,000 volts is transmitted to fifteen sub-stations by means of about 29 miles of high-tension cable, laid to all important points for service in duplicate. High-tension current is also transmitted from surface sub-stations down five different mine shafts to sub-stations located underground, ranging from 600 to 2,200 ft. below the surface. Cables at these points are carried directly to transformers without the use of switches or cut-outs. This method was adopted as a precautionary measure to prevent accidents to natives due to coming into contact with dangerous high currents in any point underground.

This cable was supplied by the British Insulated Wire Co. It is three-core and suitable for three-phase working at 5,000 volts, insulated with patent impregnated paper, lead-covered and armored over the lead with a double layer of steel tape, laid on to a bed of impregnated jute,



The Rock Shaft of the Premier Mine.

and gearing arranged to be driven electrically.

There is a 5½x8-in. Hayward vertical triplex feed pump driven by a vertical steam engine, capable of delivering 50,000 lb. of water per hour against a head of 160 lb. per square inch, with a steam pressure of 145 lb. the temperature of the water being 210° Fahr. The pump operates at 43 r.p.m. and the engine at 150 r.p.m. There is also one 5½x8-in. electrically driven Hayward vertical triplex feed pump for same duty.

A feed-water filter manufactured by Mather & Platt, Manchester, England, is installed for removing oil and impurities, and capable of treating 50,000 lb. of water per hour. The water is further filtered through coir mattresses and towel filters.

The condensers are capable of dealing with 40,000 lb. of exhaust steam per hour each, having 5,000 sq. ft. of cooling surface, and consisting of 1¼-in. tubes of about 18 gauge.

There are two 8-in. Gwynne's centrifugal pumps, together capable of delivering the water required to condense 40,000 lb. of steam per hour to a height of 40 ft. The speed of these

served over all with another layer of jute yarn, and thoroughly compounded.

The high-tension cables used for shaft work are rubber insulated, lead sheathed and steel wire armored, and were supplied by Siemens Bros., being supported in shaft by means of hardwood cleats.

Low-tension cable is used for transmitting power from the underground sub-stations to the different points necessary to operate motors driving pumps, haulages, hoists, creepers, and for electric traction. Approximately 3 miles of this cable is in use at the present time.

This cable, which is three-core, was supplied by the British Insulated Wire Co., and is suited to work at any pressure up to 500 volts, insulated with patent impregnated paper, lead-sheathed, armored with two steel tapes laid on a bed of impregnated jute served over all with a layer of jute yarn, thoroughly impregnated with preservative compound.

Alexandersfontein Electric Railway.—This line has been constructed by the De Beers Co. for the purpose of providing the employees of the company and the residents of Kimberly and

Beaconsfield with a cheap means of getting out to the only pleasure grounds within easy access of Kimberly, which are at the Alexandersfontein Hotel, a magnificent place owned by the De Beers Co.

The line equipped is approximately 7 miles in length, without stops between termini, and is operated by current supplied from the central power station.

There are four cars, two open cars with four-

has just been taken over and is operating successfully.

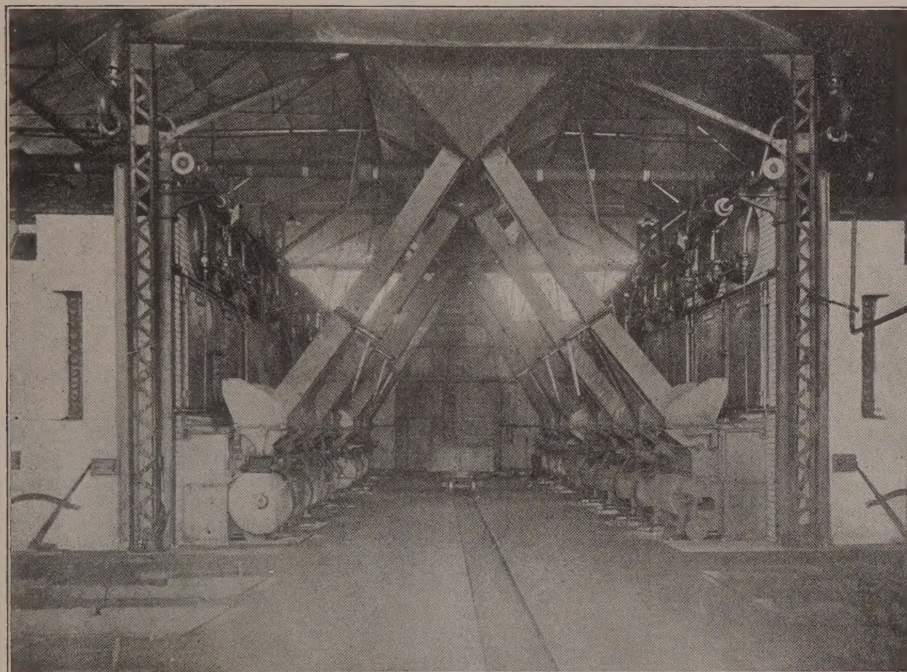
Electric power is used throughout the works, in the workshops and in the mines, a large number of electrically-operated pumps are in service, as well as twelve Baldwin-Westinghouse electric locomotives.

The supply being alternating current, the flexibility of this system is shown to best advantage, the various sub-stations in service ar-

New Method of Laying Concrete.

An unusual concrete wall for a cylindrical water tank has recently been constructed by Mr. J. F. Lyman, of Modesto, Cal. The novelty lies in the method of carrying out the work. Within the forms for the outer and inner faces, collapsible cylindrical forms, of a diameter somewhat less than the thickness of the wall, were placed vertically at intervals. These were perforated with several holes, and were inserted for the drainage of the fresh concrete. The space between the outer forms was filled with concrete, which was given an over-night set, then the water which had collected within the cylindrical forms was drawn off and the space occupied by them filled with concrete. The hollow cylinders, it is stated, contained from 2 to 6 in. of clear water at the end of from 10 to 12 hr., that had drained into them from the concrete. The object in providing this extra drainage was to procure a more uniform set through the cross-section of the wall. A large number of concrete structures have been built by Mr. Lyman in this manner, including the head gates, waste weirs, drops, and highway bridges on a large irrigation project. Concrete laid by this method, he says, is unusually uniform in strength, free from cracks and homogeneous in appearance.

A DOUBLE-ACTING GAS ENGINE of 250 h.p., working on the Otto cycle and operated in connection with a Deutz gas producer, is credited in a recent issue of "L'Eclairage Electrique" with a performance on test of 0.744 lb. of coal per brake-horse-power-hour. Coal of a calorific value of 14,600 B.t.u. per pound and containing 3.1 per cent. of ashes and 17.1 per cent. volatile matter was used. The water consumption of the plant, the mean engine load being 222.5



Interior of Boiler Room, Central Power Station.

teen seats, one ten-seat open car, and one enclosed car of the California type. These were supplied by the John Stephenson Co., Elizabeth, N. J., and have trucks manufactured by the Peckham Manufacturing Co., Kingston, N. Y. The electrical equipments consist of two quadruple equipments of four 35-h.p. No. 49 Westinghouse motors and No. 403 type Westinghouse controllers; also two double equipments consisting of two 35-h.p. Westinghouse No. 49 motors with No. 200 type controllers. The fourteen-seat cars are fitted with Christensen air brakes.

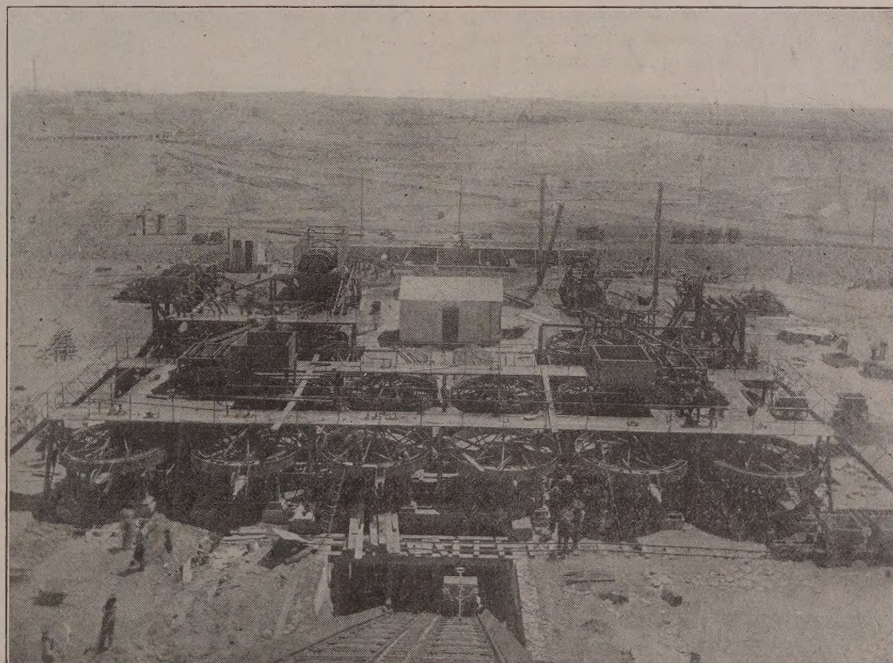
Sub-station Apparatus.—This consists of the following:

(1) Two 300-kw. Westinghouse rotary converters, three-phase, 50-cycle, 350/575 volts, 6,000 alternations, together with a direct-connected starting motor.

(2) Six 110-kw. single-phase 50-period, 5,000 to 350 volts, oil-insulated self-cooling Westinghouse transformers.

(3) The switchboard, which is made of white Sicilian marble, consists of two A. C. rotary panels, two D. C. panels, one load panel, three feeder panels, and one hinged bracket having two voltmeters.

The foregoing deals in a general way with the power station outfit and the use made of the current generated at present. An order has just been placed with the British Westinghouse Electric & Mfg. Co., London, for another unit of 1,500 kw. capacity. This has been found necessary owing to the increased demand for power in the works, and also for the operation of the Kimberly to Alexandersfontein electric railway. Arrangements have also been made with the Beaconsfield Town Council, which is a suburb of Kimberly, to light up the town, and further to operate the Kimberly to Beaconsfield tramway. The Kimberly town lighting



View of No. 4 Washing Machine.

ranging the voltage to meet all requirements for continuous and uninterrupted service.

A STONE MASONRY DAM 141 ft. high forms part of the water-works of Solingen, Germany. It has a length of 125 ft. at the bottom and of 585 ft. at the top, and its thickness at the foundations is 120 ft. and at the crest 14 ft. 9 in. It is curved against the water impounded on a radius of 492 ft.

b.h.p., was as follows: Consumed in the producer, 140 lb. per hour; in the scrubbers, 3,180 lb. per hour; cooling water in the cylinder, 46.7 lb. per brake-horse-power-hour; cooling water in the piston, 17.6 lb. per brake-horse-power-hour. The temperature of the gas leaving the scrubbers was 338° Fahr., and the calorific value of the gas ranged from 2,280 to 2,444 B.t.u. per pound. The engine had a 21.2x27.6-in. cylinder and operated at 150 r.p.m.

Air-Lift Pumping Plant of the Redlands Water Co.

A test was recently conducted on an air-lift pumping plant in the irrigation works of the Redlands Water Co., Redlands, Cal., to determine its efficiency. The works supply water to about 1,000 acres of land, practically all of which is set out in orange groves. The supply was formerly obtained from the Bear Valley irrigation system, but during three months in the summer this system was unable to furnish water, and deep wells were sunk to afford a supply to cover the deficiency. The part of the works at the pumping plant before the installation of the air-lift system embraced four wells from 415 to 570 ft. deep, a boiler and engine house, a receiving basin and a storage reservoir. One of the wells was operated by a centrifugal pump driven by an electric motor, one by a plunger pump driven by an auxiliary steam engine, the third by a centrifugal pump driven by a steam engine, while the fourth was not in use. It was decided to replace these pumps and machinery by some system which would be adapted to the varying heights of the ground-water level and at the same time could be applied from one plant to all four wells, which are 50 to 150 ft. from the central point.

The wells are sunk through strata of clay and gravel which are very irregular in formation, the clay being encountered in pockets of varying thickness and at various elevations in the different wells. It was determined that the greater part of the supply was drawn from the upper part of the wells, and when the three that were in operation were being drawn upon at the usual rate the ground water level, which usually stood within about 45 ft. of the surface, was drawn down from 20 to 25 ft. A drainage area of 1.54 sq. miles is immediately tributary to the wells, and it was considered that, if this local drainage basin alone supplies the wells, the present rate of extraction would lower the water plane. The depth of the ground water below the surface and the draft upon it is also dependent to a considerable extent upon the yearly variation of rainfall. Any system to be installed was required to be sufficiently flexible to meet the varying heights of suction lift.

The installation of a reciprocating steam pumping plant was not feasible, as the sinking of a large pump shaft connected to the various wells by tunnels was held to be comparatively impracticable, owing to the gravelly nature of the soil and to the proximity of the tunnels to the storage reservoir. There was also liability, in case the shaft was sunk and the tunnels run, of the water plane afterward dropping below the proper suction lift of the pump. In this event, although the shaft and pump might be lowered, the tunnels could not be conveniently lowered.

While electrically-driven centrifugal pumps are adapted to conditions similar to those of this plant, the local high cost of electric power prevented their installation. Power cost 2.5 cents per horse-power-hour for the motor that was already in operation, making the cost per water horse-power-hour between 5 and 7 cents, depending on the efficiency of the pump. The separate engine required at each well by steam-driven centrifugal pumps was undesirable, and the high cost of fuel for a gas-engine plant made such an installation impracticable.

An air-lift system operated by a central compressor plant was considered to afford the most economical means of meeting the situation, so the wells were fitted with air and discharge pipes, and a complete compressor plant installed. The discharge pipes vary from 4 to 7 in. in diameter and extend from 306 to 360

ft. down in the wells. The air pipes, from 1½ to 2 in. in diameter, reach down from 300 to 312 ft. inside the discharge pipes. The plant is placed in a 40x46-ft., one-story brick engine house, with a corrugated iron roof. A 16x5½-ft. oil-burning horizontal tubular boiler, made by the Murray Iron Works, of Burlington, Ia., supplies steam to the air compressor, made by the same company. It is a cross-compound Corliss compressor with a 12-in. high-pressure steam cylinder, a 14-in. high-pressure air cylinder, a 26-in. low-pressure steam cylinder and a 22-in. low-pressure air cylinder, all with a 30-in. stroke. The machine was designed to develop 190 i.h.p. when running at 85 r.p.m. and ¼ cut-off, steam being supplied at 125 lb., and the engine operating condensing. Under these same conditions the compressor has a guaranteed capacity of 1,124 cu. ft. of free air per minute compressed to 125 lb., which is equivalent to 938.83 cu. ft. per minute, when the compressor is operating at 71 r.p.m., the normal rate of operation. The air receiver is 3 ft. in diameter and 8 ft. long, with shell plates ¾ in. thick and heads ¾ in. thick.

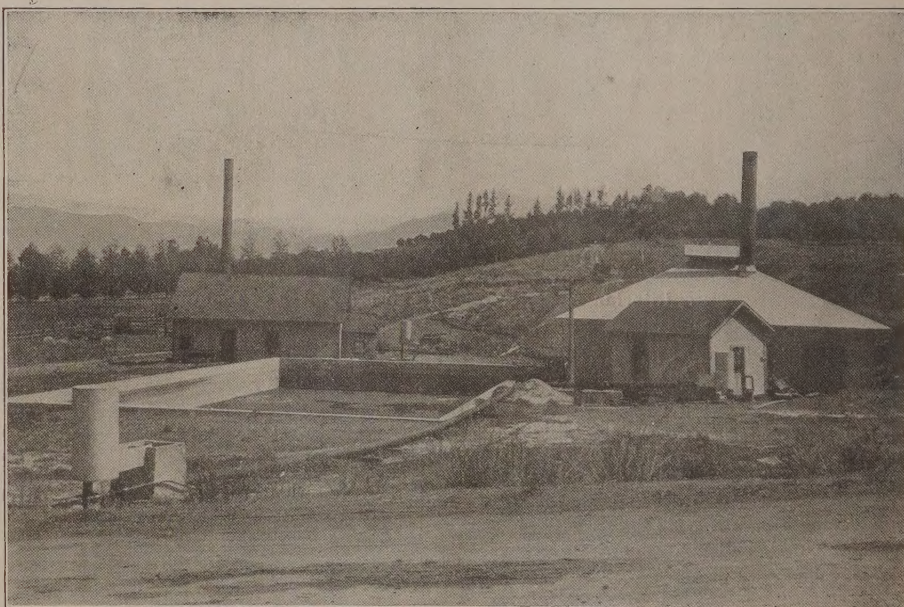
A 2½x4-in. Smith-Valle triplex pump and a 4½x3x4-in. Smith-Valle duplex pump furnish

increase in flow of about 100 gal. per minute. Crude California oil was used in the burners under the boilers. The quantity of oil consumed was measured by noting the fall in two

Table of Conditions Existing During 48-Hour Test on Air-Lift Pumping Plant of The Redlands Water Co., Redlands, Cal.

Pressure:	Max-imum.	Mean of 48 hourly obser-vations.	Min-imum.
Boiler, lb. per sq. in.	150.0	146.7	142.0
Air, comp. gauge, lb. pr sq.in. 94.0		90.98	85.0
Steam, in recvt, lb. per sq.in. 14.5		12.45	11.0
Air, intercooler, lb. pr sq.in. 20.0		19.3	19.0
Vacuum, in. of mercury	25.25	24.83	24.5
Well No. 1:			
Air pressure, lb. per sq. in. . .	89.0	87.4	84.0
Water, below surface, ft.	109.0	101.44	98.0
Well No. 2:			
Air pressure, lb. per sq. in. . .	95.0	93.6	92.0
Water below surface, ft.	93.0	90.37	86.0
Well No. 3:			
Air pressure, lb. per sq. in. . .	90.0	87.03	85.0
Water, below surface, ft.	116.0	110.67	99.0
Well No. 4:			
Air pressure, lb. per sq. in. . .	86.0	85.4	84.0
Water, below surface, ft.	105.0	102.2	101.0
Fuel consumption, bbl. pr 24 hrs 17.2		16.3	15.7
Rate of pumping, gal. per 24 hrs—Maximum, 3,280.			
824: mean of 48 hourly observations, 3,157,622;			
minimum, 3,131,395.			

large storage tanks, whose capacity had been accurately determined. The flow of water was measured by a weir in the concrete wall between the discharge compartment and the receiving



Pumping Station, Redlands Water Co., Showing Three Well Heads.

water to the boiler. The surface condenser used is shown in an accompanying cut. It is placed in a compartment beside the receiving basin. The wells discharge into this compartment, and the water flows from it over a weir to the basin. The condenser consists of small brass pipes with about 300 sq. ft. of cooling surface, and as it is always submerged when the plant is in operation, it forms a surface condenser without the usual cast-iron shell. A 6½x10-in. belt-driven vacuum pump is operated in connection with it. An enclosed exhaust-steam feed-water heater is placed in the exhaust main of the engine, and a hot well is also provided. The boiler is placed on concrete settings and all the machinery was set on concrete foundations.

The test was conducted for 48 hours a few days after the machinery was in place, with normal conditions of operation, the object of the test being to determine the amount of fuel used in each 24 hr. when lifting and discharging certain quantities of water, and not drawing the water plane below certain elevations. The engine was run at 71 r.p.m., but toward the end of the test the speed was increased to 76 r.p.m for 33 minutes, with a corresponding

basin, and checked by noting the height of water in the basin, the quantity per foot of depth in it having been previously obtained.

The accompanying table gives the results of the test, only the maximum, minimum and mean values of 48 hourly observations being given. As may be seen from the table, the range of values in all cases was comparatively slight, the arrangement of the plant permitting unusually uniform conditions to be maintained. The test was conducted by Mr. T. S. Smith, as engineer for The Pacific Coast Mfg. Co., the firm which furnished and installed the machinery; Mr. O. K. Parker, as representative for Mr. J. B. Lippincott, consulting engineer, of Los Angeles, and Mr. Jas. N. Clark, superintendent of the Redlands Water Co.

THE FUEL CONSUMPTION per effective horsepower of a 6,000-h.p. Goerlitz triple-expansion steam engine and a 4,000-h.p. Parsons-Brown-Boveri steam turbine was compared some time ago in a paper read by Prof. E. Josse before the Society of German Engineers. It was about equal in the two cases at a load of 4,500 h.p., but rose rapidly with lower loads in the case of the steam turbine.

Notes on Foreign Bridge Erection.

A recent paper by Mr. R. S. Scholefield before the Institution of Civil Engineers gives considerable interesting data on the methods of bridge erection practiced in the United States and abroad, a large portion of which has from time to time been published in *The Engineering Record*. Among the works mentioned, descriptions of which have not been previously published in these columns, some of the more interesting or important ones are here briefly noted. The Empress bridge over the Sutlej River, India, includes several spans of 257 ft. on centers of piers, two of which are over water of 42 and 56 ft. in depth and were erected on falsework made with four piles in each transverse bent. The piles were of round timber spliced with fish-plates made of rails, and were braced under water by diagonal chains attached to the bottoms of the piles with screw couplings. "The piles were protected at the bottom with cubical blocks strung on them like beads on a string." The working platform was built on four lines of longitudinal horizontal beams capping the pile tops which were not connected by transverse beams. These beams

The 470-ft. 1,587-ton tubular spans of the Britannia Bridge, England, were floated to the base of their piers and were lifted 100 ft. to the final positions by special hydraulic presses under each end. A similar method was employed for the erection of the 455-ft. spans of the Saltash Bridge and fifteen 168-ft. spans in the approaches of the Forth Bridge were lifted 130 ft. to their required level by hydraulic rams simultaneously with the construction of the piers which eventually supported them.

A 200 or a 250-ft. span on the Bellary-Kistna section of the Southern Mahratta Ry., India, crossed a very deep ravine where the construction of falsework was considered prohibitive. It was erected in the bottom of the ravine on low falsework and was lifted to the required position by hydraulic jacks simultaneously with the building of the pier masonry. Special provision was made to prevent the falling of the girder in case of any failure of the jacks. A pair of small girders was attached to each end of each girder and projected beyond it, carrying four vertical 12 x 12-in. legs symmetrically arranged around the bearings and projecting downward from them, thus forming supports for the girder outside of the jacks. A well hole

The 150-ft. spans of the Crumlin Viaduct, England, were assembled at ground level and lifted 200 ft. to the required position by tackles operated by ordinary hand windlasses at a cost said to have been about \$7.50 a ton exclusive of the cost of the tackle.

The thirty 115-ft. bow-string girder river spans of the double-track railroad bridge at Mayence, were replaced in nine weeks in 1901. Traffic was restricted to one track while the girders for the other track were replaced. A pair of traveling gantries of 40 tons capacity, 60 ft. transverse and about 80 ft. vertical clearance were built to move on a low-level track from end to end of the bridge alongside of the latter and clearing it and the train service. These gantries were provided with trolley hoists moving transversely across them with which the pair of girders for each single track were lifted from their position 40 ft. above the ground, moved across and deposited on trucks on the track in service alongside. The new spans weighing 76 tons each were then brought in on the same track and lifted off and placed in position by the same method. The total weight of the old structure was 600 tons and of the new structure was 1,100 tons.

The Regoa Bridge has one 263-ft. and four 162-ft. spans across the Douro River, Portugal, at a height of 84 ft. above low water. As the river is subject to sudden floods of as much as 72 ft., it was not considered advisable to build falsework and the bridge was erected on a temporary platform made with Howe trusses 322 ft. long and 13 ft. deep, spaced far enough apart to give clearance for the erection of the new span between them. This platform was built on shore and projected from the abutments to the successive piers by windlasses hauling it over roller bearings. It was reinforced during erection by temporary trestle piers in the middle of each short span and by two under the long spans.

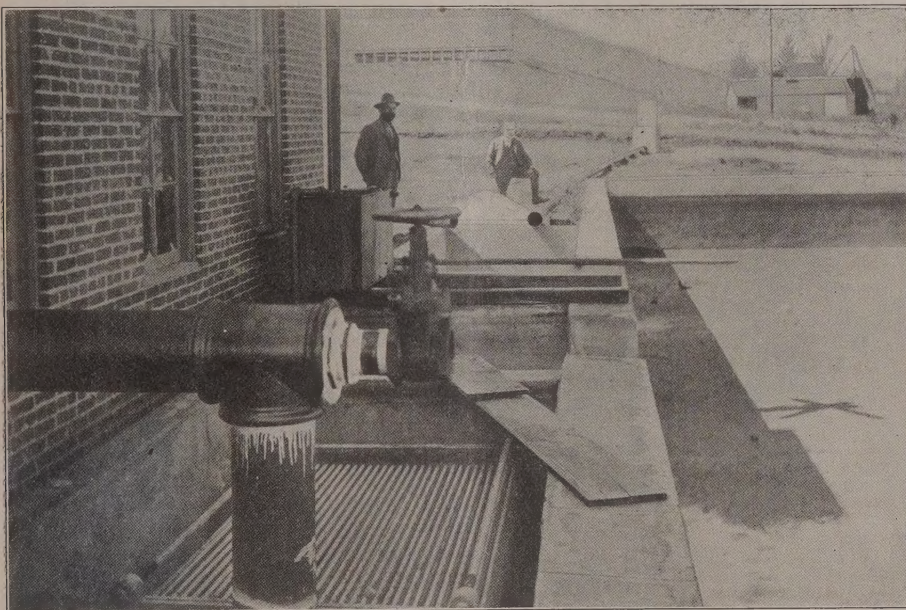
Among the numerous examples of continuous span bridges which have been erected on shore and moved to position by launching on rollers from pier to pier, some of the more important are the Fribourg Bridge with 160-ft. spans which were pulled forward with tackles operated by windlasses on the abutment. The superstructure was built before the substructure and the projecting span was used as a cantilever arm from which the materials were lowered and the erection of the successive towers was accomplished.

The Stadlau Bridge, Vienna, has five 232-ft. spans weighing in all 2,100 tons and was erected at a cost of from \$0.40 to \$0.60 per ton.

The Tardes Viaduct near Evaux, France, has two 228-ft. side spans and one 328-ft. center span which was erected by protrusion with a temporary pilot girder projecting from the forward end so as to take bearing on the pier before the center of gravity passed beyond the preceding pier.

Mention was made of one bridge having fifty-eight 70-ft. spans, three bridges having twenty-four 70-ft. spans, and many other similar cases of 4-ft. plate-girders continuous over two spans which were erected by protrusion over the piers and abutments. In this system, groups of four simple cast-iron rollers were spiked to sleepers on each pier and engaged double-headed rails laid on their sides and secured to the lower flanges of the girders to form roller tracks. A platform was built at the center of the span on the top flange and to it a windlass was bolted and operated by ten men who pulled the span forward by a line anchored to the sixth pier ahead. Track rails on the girder flanges projected beyond the front end so as to engage the pier rollers in advance of the girder and take up any deflection.

The two 140-ft. 56-ton spans of the Cauvery



Condenser Pit, Discharge Well and Weir, Redlands Pumping Station.

were wedged against the piers and were braced from end to end with diagonals made of rails, thus forming a horizontal girder 250 ft. long and 36 ft. wide. The trusses were erected by a pair of gantry cranes.

Fourteen 328-ft. 445-ton spans of the Moerdyk Bridge, Holland, were floated into position on pairs of pontoons from which they were lifted a considerable distance to their pier seats. Thirteen 363-ft. 520-ton spans of the Syzrain Bridge over the Volga were floated into position on seven barges each at a height of 120 ft. above the water.

The 260-ft. girders of the Niemen Bridge formed the walls of a temporary pontoon with watertight ends and bottom and were built on shore, launched sideways and floated to position, thus avoiding the expense of constructing special barges for their removal.

The 200-ft. 350-ton Prater Bridge of the Austrian State Railway near Vienna was erected in 1880 at the required level 18 ft. transversely from its final position. It was moved into place in 20 min. by tackles operated by four men at each of three windlasses. It was supported on cannon balls rolling between a lower I-beam and an upper channel bar.

14 in. square was left in the masonry to receive each leg and as the girder was jacked up, dry sand was poured into the holes, keeping them filled under the lower ends of the legs. This obviated the trouble and obstruction of crib work and provided for the support of the girders on well-set masonry instead of on that which had been recently laid.

At the Chittravati Bridge, India, nineteen 140-ft., 146-ton spans were erected on the river bed during the dry season and then raised to position by four 60-ton hydraulic jacks under the ends at a total cost of about \$70 a span and a little over \$100 for packing, which made the cost of lifting about \$1.25 per ton.

Some 100-ft. spans on the East Coast Ry. were erected by Mr. E. H. Stone with pier gantries or galloways frames by which they were hoisted from the ground, moved inward and lowered in place. This operation required in each six-part tackle about 700 ft. of 8-in. Manila rope worth there over \$600 and liable to destruction by decay within two years. In order to save so great a loss, the rope was returned to the makers and respun into 2½-in. and 3-in. rope for which there was always an unlimited demand for railroad use.

Bridge were erected by protrusion for about \$120 each, and twenty-four 70-ft. spans of the same bridge were unloaded, erected and riveted in the same manner for about \$13 a ton. From eight to twelve 70-ft. spans could thus be erected in one day and as many as fourteen spans had been accomplished in that time. In this method of erection it has been found necessary to elevate the forward part of the girder 20 in. or more to allow for the deflection in long spans. When the spans are advanced by turning the rollers, it becomes difficult to operate them simultaneously for a number of long spans and at Cubzac all of the ratchet levers for the rollers were operated by ropes to a steam engine.

In order to prevent the concentration of the weight at the roller bearings, a number of rollers are sometimes used which are seated on a rocking beam such as was used for the Tardes Viaduct. This beam was a plate-girder with a center bearing on the lower flange. Two bearings $8\frac{1}{2}$ ft. apart were provided on the top flange and each of them supported a short plate-girder balanced over it and carrying at each end a pair of rollers. Thus the lower flange of the girder was supported at each of four points by a pair of rollers and the rollers were supported by two sets of double cantilevers providing for the distribution of pressure on the girder flange and possible concentration on the pier top.

The 230-ft. arch span of the El Cinca Bridge, in Spain, was erected by the cantilever method using the horizontal top chord as a temporary anchor tie in a manner similar to that described in The Engineering Record, in the erection of the railroad arch span at Niagara Falls. The erection of this bridge cost about \$10,000, equivalent to over \$40 per ton.

The Findhorn Viaduct, of the Highland Ry., England, is 150 ft. high, and seven 130-ft. truss spans were erected on ingenious temporary telescopic platforms. These platforms were made with pairs of trusses assembled between the trusses of the end deck span of the permanent structure under its roadway and fitted with grooved reaction wheels on top of each truss which engaged two lines of longitudinal rails fastened to the under side of the permanent span floorbeams. These temporary wooden trusses were pushed forward telescopically on rollers until they reached across and their forward ends were seated on the next pier in advance. Hinge brackets were then let down on the outside of each truss and guyed to the top chord, supporting platforms on which new spans were erected, after which the telescopic trusses were advanced for the next span and so on.

Eleven 160-ft. spans of a high viaduct in South Wales were erected without falsework by a simple and ingenious use of one span for erection purposes. The first span of the viaduct was erected on falsework and between its girders the pair of girders for the last span were erected and were successively lifted by a trolley running on the top chords of the first-span girders. The trolley carried these girders forward until their extremities were a little beyond the center of the next span, when they were supported on the top of the pier with the rear end secured to the first span. They thus formed cantilevers with the fulcrum on the pier and the finished span as an anchorage. Meantime the girders intended for the second span had been assembled on the falsework and were successively lifted by the trolleys and carried out to the end of the cantilever girders, whence they were deposited on the first and second piers. They were moved transversely to the required position and served to support the two cantilever girders which were moved forward between them, projecting into the middle of

the next span and serving for the erection of the third span and so on.

During the Afghan War a 150-ft. span was erected in great haste over a ravine 500 or 600 ft. deep where no erection material was available, except rails, sleepers and the sections of two 150-ft. span trusses. One of these spans was erected upside down on each side of the ravine, the joints being assembled with bolts instead of rivets. The girders were rolled forward so that each overhung the abutment about 90 ft. and the shore ends were counterweighted with rails. The gap between them was then bridged with a 40-ft. beam and the girders of the permanent span were erected upon the temporary bridge thus formed.

Three spans of the six-span Yenissei Bridge of the Trans-Siberian Ry. were erected on falsework on each bank of the river. The center spans were assembled in the axis of the bridge and were rolled longitudinally on low-level falsework to the required position. The second spans were then moved over transversely into the axis of the bridge and rolled out to their positions and were succeeded by the third span, this method being adopted to save time and per-

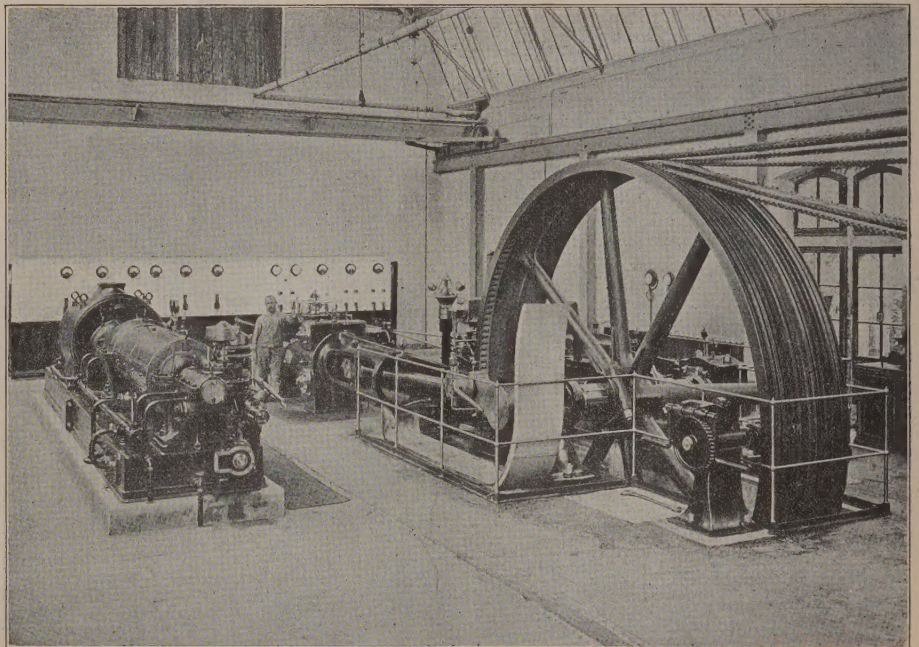
Practical Data on European Practice with Steam Turbines.

By Franz Koester.

The remarkable development of the steam turbine in this country in connection with power plants makes it of interest to discuss European practice, which has covered a period beginning perhaps ten years before active work was started here. The lowest steam consumption under actual working conditions in Europe is 9.11 lb. per indicated horse-power-hour, although this does not include the power required to operate the condenser outfit, which in this country is usually considered not over 5 per cent. The lowest record for reciprocating engines is 9.41 lb. (including condensers), which is attained both at one of the street railway power plants in Berlin and in Vienna.

Although there are some half-dozen different types of turbine in use on the continent, the Brown-Boveri-Parsons is the most popular, being installed in some 150 plants throughout Europe.

The rapid increase in the use of the turbine during the past five years was due very largely



A 600-H.-P. Turbine and a 450-H.-P. Reciprocating Engine.

mit the simultaneous erection of the entire superstructure.

It is stated that in India there is an abundant supply of excellent skilled and docile native labor and that 5,000 such men will come from distances of from 1 to 2,000 miles to work for an engineer in whom they have confidence. Intemperance, ill-discipline and strikes are practically unknown among them and the men, especially those from the Punjab, are ambitious to hasten the work when necessary on account of threatened floods. They have recently commenced to take contracts for erection work, the scale of prices being about \$3 a ton for 10 to 40-ft. girders, \$5.50 for 40 to 100-ft. girders, \$6 to \$7.50 for 150-ft. girders, and \$10 for 200-ft. girders. These prices included the removal of the falsework and placing it in storage, but did not include the coal for rivet heating and, of course, varied somewhat according to local conditions.

BALL BEARINGS FOR ELECTRIC MOTORS made up of felt-filled lubricating springs alternating with the balls instead of balls alone, were described recently in the "Electrical Engineer" of London.

to the successful operation of the municipal plant in Elberfeld, Germany, for running the suspended railway between Elberfeld and Barmen. Here they have two 1,000-kw. Parsons turbines, which operated even at the early date of their installation with a minimum steam consumption of 12.3 lb. per indicated horse-power per hour for one, and 12.1 lb. for the other.

The steam turbine, like the reciprocating engine, may be run both condensing and with free exhaust, and the jet condenser, the surface condenser, the siphon condenser, or a central condensation system may be employed. As there is no oil used in the steam chambers of the turbine, the water from the condenser may be used directly for boiler feed or for other purposes, and it is not necessary to filter it and thus lose a large portion of its heat. The absence of oil in the condensed steam is of special advantage when surface condensers are used, as in this case the cooling water does not mingle with the condensed steam, and the feed water returned to the boilers is thus always pure and free from sediment. It is for this reason that surface condensers are specially appropriate for turbine plants. Quite contrary to the practice

in this country, most of the condensers and pumps in these plants in Europe are driven by electric motors. One of the engravings shows a motor-driven condenser for a 5,000-h.-p. turbine.

A turbine lends itself much more readily to the advantageous use of superheated steam than a reciprocating engine, on account of the absence of pistons, stuffing boxes, and cylinder lubrication. As the economy due to superheated steam increases directly with the temperature, the turbine presents another advantage, be-

the steam consumption will be considerably less than 9 lb. per indicated horse-power per hour.

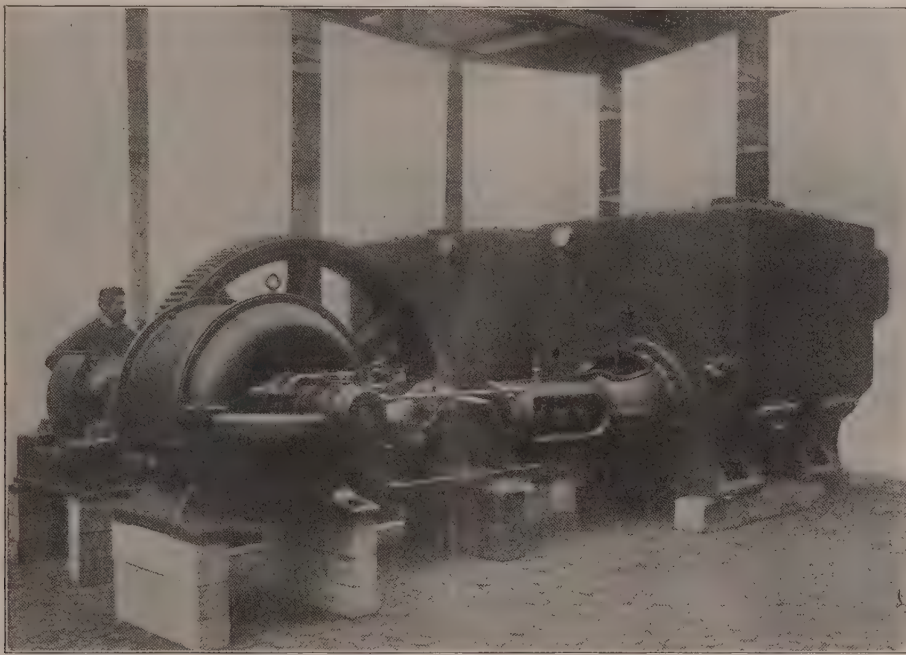
In comparing the results of the turbine tests with those of reciprocating engines it must be borne in mind that it is usual to make special preparations before testing reciprocating engines, while there being no parts of the turbine subject to excessive wear, there is no necessity for special preparation at the time of test; indeed, tests made several years apart will show the same results.

In comparing performances of reciprocating engines with those of turbines, it is necessary, not only to take into consideration the steam consumption of the engine and turbine, but also to consider the wear and tear on the engine and the oil required.

The Bavarian Inspection Society thoroughly investigated this subject of oil and found that in compound and triplex expansion engines of 100 to 1,500 h.-p. the oil consumption was about 2 grammes per horse-power-hour, costing 1/40 cent. In the Parsons turbine the oil consumption is practically negligible as compared with reciprocating engines, the figures being 0.1 to 0.3 gramme per horse-power hour in units of 100 to 1,500 h.-p. With the reciprocating engine the cost of the oil consumed amounts to 7 to 15 per cent. of the cost of the coal used, while with the Parsons turbine the cost of the oil ranges from 1/2 of 1 per cent. to 2 per cent. of the cost of the coal.

The attendant delay due to the preparation of an additional reciprocating unit for service is entirely avoided with the turbine, for it is equipped with a by-pass valve by means of which steam at full pressure may be admitted to the second or low-pressure steam chamber; and the capacity of the turbine is thus largely increased. This by-pass is also of great advantage in case of an accident to the condensing apparatus which would necessarily decrease the power of the turbine, just as it would in the case of an engine. The use of this by-pass, however, means a less economical steam consumption.

A REINFORCED CONCRETE WATER-POWER PLANT is being completed for the Janesville, Wis., Electric Co. It contains six Samson turbines, built by the James Leffel Co., of Springfield, O. The foundation, flume, walls and penstock are of concrete with steel reinforcement, and the



Motor-Driven Condenser for a 5,000-H.-P. Brown-Boveri-Parsons Turbine.

cause there is practically no limit to the superheat it can stand.

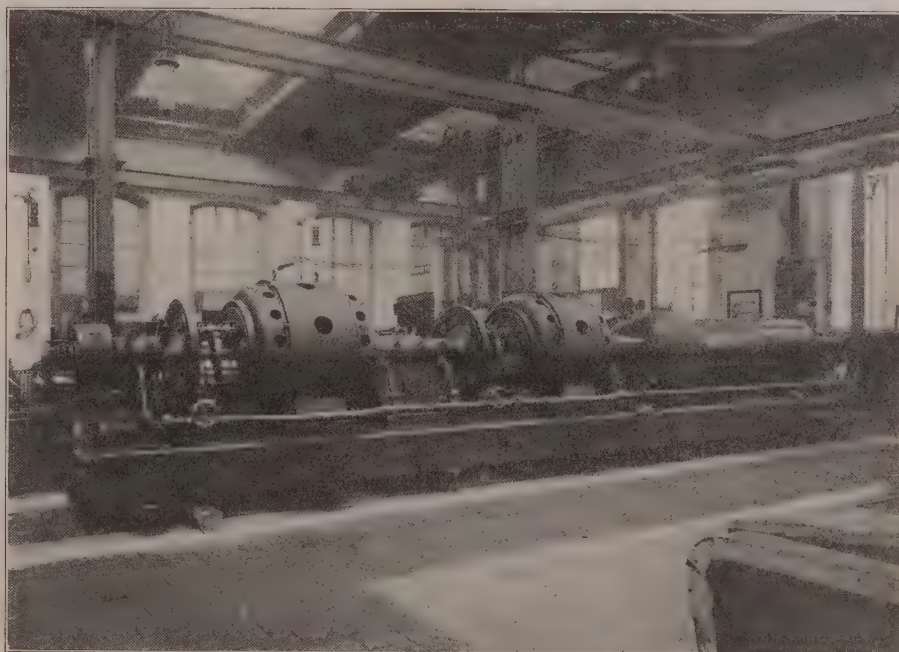
The steam consumption of the Parsons turbine, used on the continent, as already shown, will compare favorably with that of the best compound engine built to-day. The accompanying table gives some data regarding the steam consumption of Parsons turbines furnished by Brown, Boveri & Co., of Baden, Switzerland, and installed in a number of different plants. All the turbines are run condensing and the steam consumption given in the table includes that required for the auxiliaries, except those cases marked *, where this work is not included. The table shows clearly the decrease in steam consumption as the size of the turbine

Table Showing Performances of Brown-Boveri-Parsons Turbines, Direct-Connected to C. E. L. Brown Electric Generators.

Location of plant.	Output, kw.	Output, hp.	Lbs steam pressure, absolute.	Temp. steam, degs. Fahr.	Steam, lbs. per i.h.p. hr.
Refrigerating plant, Berlin.*	100	133	129	372	15.6
Electric plant, Chur.	200	267	184	482	13.6
French navy yard*.....	280	420	216	+	13.3
Nord-Deutscher Lloyd, Bremen	300	400	147	+	14.0
St. r'y Linz, Switzerland..	300	400	132	+	14.3
Cellulose factory, Villach..	350	467	169	482	12.1
Rolling mill, Antonienhütte*	400	533	110	+	13.0
Ship yard, Kiel,*	400	533	132	+	13.0
Spinning mill, Colmar*....	400	533	162	445	11.7
Mine and Pottery, Tschopeln	400	533	110	406	13.0
Iron & st'l wks, Diedenhofen	450	600	118	482	11.8
Iron and steel works, Hüsch*	500	667	110	452	12.5
Schleper & Baum, Elberfeld	500	667	147	482	11.6
Municipal plant, Frankfurt*	3,000	4,000	162	572	9.11

*Steam for power to operate condenser not included.
†Saturated.

and degree of superheat increase, and from the data here given it may safely be expected that in the 10,000-h.-p. turbine, which is at present being constructed by Brown, Boveri & Co., that



A 750-H.-P. Turbine Connected to Two 250-Kw. Direct-Current Dynamos.

As an example of the stability and slight wear of the turbine, it may be interesting to refer to the 500-h.-p. Brown-Boveri-Parsons turbine in the Carlshütte at Diedenhofen, Germany, which was in service 5,800 hours continuously, except for a single stop of ten minutes' duration. At the end of the run the turbine was taken apart by the company's engineers and examined carefully for evidence of wear, of which not the slightest could be found.

building itself is formed of hollow concrete blocks. The main building is 55x80 ft., and the wheel house 16x70 ft., and there is a boiler room for an auxiliary steam plant 40 ft. square. The floor is of cement and the smoke passes through a concrete smoke tunnel under the floor of the boiler room. The plant was designed by Messrs. D. C. & W. B. Jackson, of Madison, Wis., and is the so-called central plant of the company's stations.

Small Sand Filter Plant for a Hospital at Poughkeepsie, N. Y.

There is now under construction at Poughkeepsie, N. Y., for the Hudson River State Hospital a small slow sand filter installation of more than passing interest on account of its modifications of the heretofore commonly accepted design of such filters. Although small, having a nominal capacity of only about 1,000,000 gal. per day at a daily rate of 3,000,000 gal. per acre, the plant is important owing to its novel features.

The plant is located close to the shore line of the Hudson River and comprises two concrete covered filters of $\frac{1}{2}$ acre net filtering surface each, and a filtered water reservoir of similar construction of over 200,000 gal. capacity. The main storage of filtered water is in an old reservoir on the hill. Sufficient land is owned for two additional filters. A small pumping station nearby contains two pumps for supplying raw water to the filters, and two other pumps for elevating the filtered water to the hospital. Raw water is drawn through a small intake crib in the river. The general plan and sections show the arrangement and the well-known parts of such a filter installation so clearly that it is unnecessary to describe them in detail.

The land available for the filter plant is situated between the New York Central R. R. and the river, and is a narrow strip so limited in area that it was necessary to practice the utmost economy in use of ground in the design. To meet this condition, the sand court was placed on top of the groined roof arches, symmetrical to the division wall between the two beds. This radical change in design made several other changes possible, resulting in economy and convenience in construction and operation. Sand runs with entrances from the court are no longer needed; the arrangement of the regulator house has been altered slightly so that it can be entered from the filter side, and through it access is had to each filter. By elevating the sand washer a few feet above the court and using a portable ejector to discharge the sand scraped from the surface of a bed directly to the washer, the washed sand can be discharged by gravity to the court, and from the court through trap doors into either filter. Accompanying illustrations show these novel features in considerable detail.

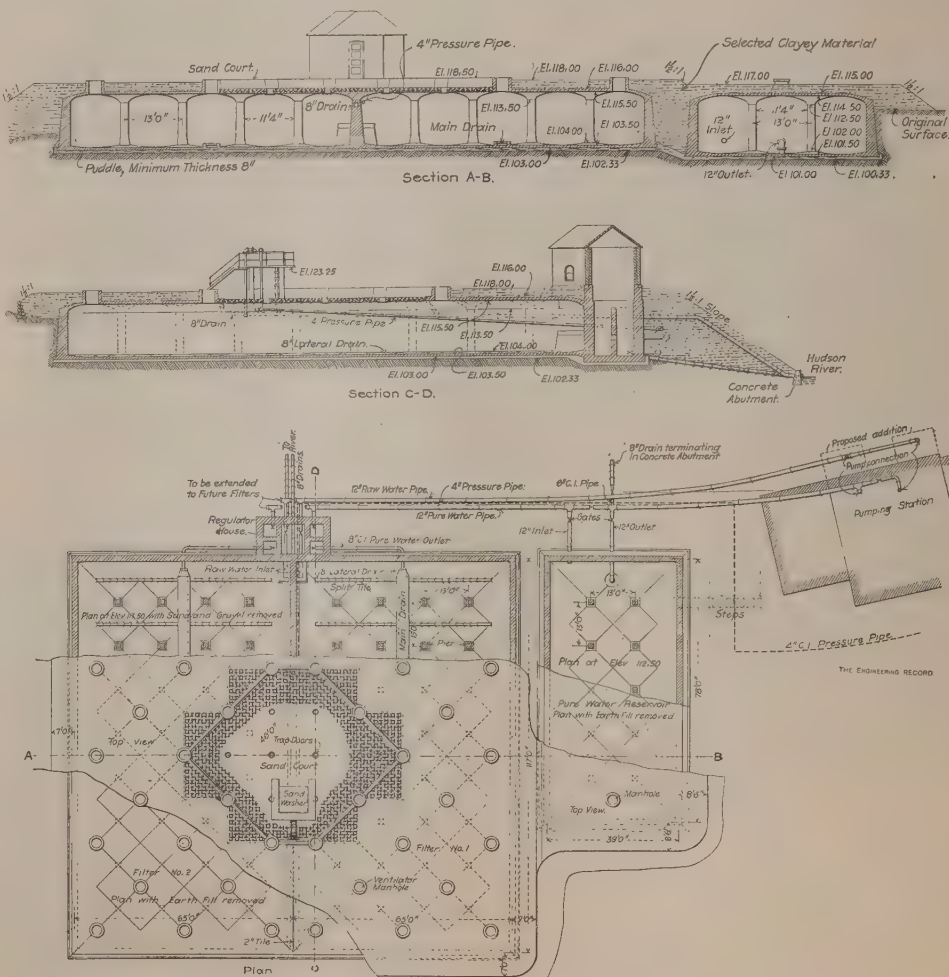
The sand court is a square 46 ft. on a side, with one diagonal in the center line of the division wall between the filters and the other in the transverse center line of the beds, having the corners on the division wall truncated. Its walls are built between the ventilator manholes, of the usual form placed at the intersections of the groins, which come on the sides of the square. The ventilators which would come within the square are omitted. The court walls are the same height as the manholes. Six inches is the usual crown thickness of the roof arches, but at the sand court the thickness is increased to about $8\frac{1}{2}$ in., including a 1-in. granolithic sidewalk finish, and the depressions at the top of the piers are, of course, filled up with concrete. Suitable slopes are given to the surface for drainage purposes.

The concrete in the roof and twelve piers under the court is made richer than elsewhere, being mixed in the proportions of 3.8 cu. ft. of Giant Portland cement to 8 of sand and 14 of broken stone or gravel, instead of 3.8, 11 and 19 cu. ft. This portion of the roof is reinforced with $\frac{1}{2}$ -in. twisted steel rods spaced 1 ft. apart in each direction, not so much for additional strength as to prevent cracking. Eight holes through the floor of the sand court, four into each filter, allow the clean sand to fall when

ever desired on the bed, leaving only the distributing and spreading to be done by hand. Each of these holes is fitted with a cast-iron thimble having a clear opening 16 in. in diameter. Each thimble is set with its top flush with the surface of the court floor and has a horizontal rib 5 in. below the top, projecting 3 in. into the concrete. The bottom of the thimble extends below the soffit of the arch and has a flange to which a cast-iron circular trap door is hinged and bolted. A facing ring on the upper side of the door and the flange are planed so as to make a tight joint when the door is bolted, as it is intended to be the greater part of the time, four $\frac{7}{8}$ -in. bolts being used. A tripping catch is also provided to hold the door in place. Whenever it is desired to admit sand to a filter, the bolts will be removed, leaving the door on the catch, which can then be disengaged by means of a shovel or bar while the man stands at a safe distance.

wall 1 ft. 8 in. from one end, extending down 2 ft. from the top. The second tank is divided by a longitudinal wall into two compartments each 2 ft. 3 in. wide and 7 ft. long. The first compartment is 18 in. and the second is 22 in. deep. A cross-wall with its top 10 in. below the top of the bank cuts off a chamber 18 in. wide at one end of the second compartment. The two tanks are placed close together and a lip on the wall of the first tank overhangs the adjoining wall of the second tank.

Two 3-in. wrought-iron pipes rise beside the end of the first tank, one from each filter, to which the discharge hose of the sand ejector can be attached. These two pipes end in elbows turned down into the small compartment of this tank. The mixture of sand and water discharged from the one or the other of the pipes feeds beneath the curtain wall into the larger compartment, where there are a $2\frac{1}{2}$ -in. cast-iron header and six $\frac{3}{4}$ -in. brass pipes arranged



General Plan and Sections of Filter Plant for Hudson River State Hospital.

At each end of the court, over the division wall, there is a catch basin connecting with an 8-in. cast-iron drain buried in the upper part of the division wall. The wall of each catch basin is built up of rabbeted cast-iron half rings $3\frac{3}{4}$ in. high, thus permitting adjustment to suit the level of the sand in the court. There is a screen of 1-in. mesh in the outlet of each basin.

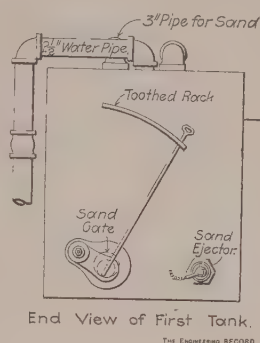
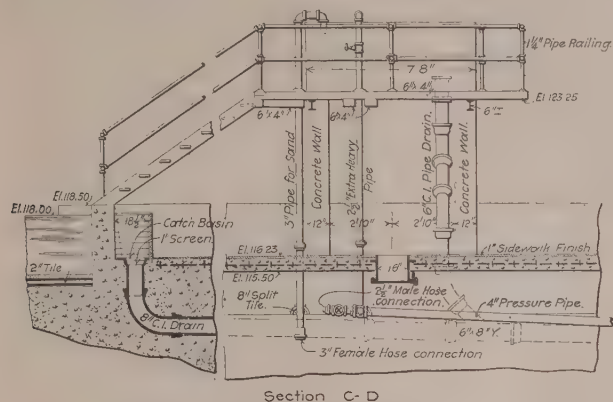
The sand washer is a development of the simple device used at Yonkers last summer for washing the sand as it was taken from the bank, and described in this journal July 2, 1904. For the wooden box employed at Yonkers concrete-steel tanks have been substituted. There are two tanks supported on two 12-in. concrete walls 7 ft. high standing on the sand court floor. The principal tank is 7 ft. long, 3 ft. deep and 2 ft. 4 in. wide, and has a curtain

as shown in one of the cuts. The header is fed by a $2\frac{1}{2}$ -in. pipe rising from a 4-in. pressure main from the pumping station. The brass pipes are about 4 ft. long and each has forty-four $1/16$ -in. holes in its upper side, staggered. When washing, water will be admitted to the pipes and will rise upward through the sand, carrying the dirt with it. Only a nominal water pressure is required for a washer of this type, but in this case water is available with a pressure of 100 lb. per square inch, and the piping is designed accordingly; it would have to be much more ample if the pressure were less. The dirty water will flow over the lip of this compartment into the first compartment of the other tank, which will act as a trap to catch any sand that may be carried over with the water. From this compartment the water will

flow on into the larger chamber of the second compartment, which will serve as a second sand trap, and thence into the small or outlet chamber. A 6-in. drain leads from the last chamber down into the 8-in. drain in the top of the division wall. It is anticipated that considerable sand which would otherwise be wasted in the process of washing will be recovered by

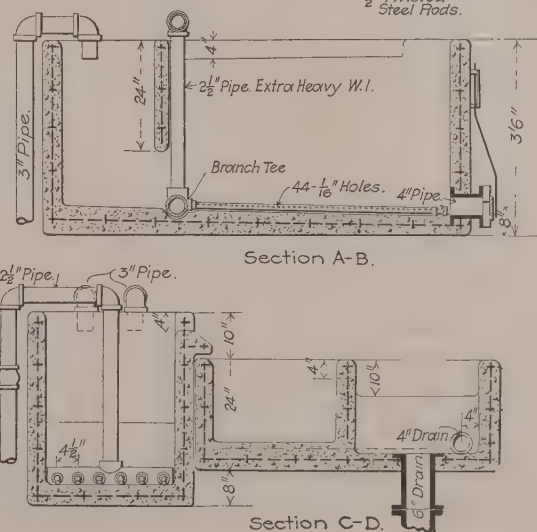
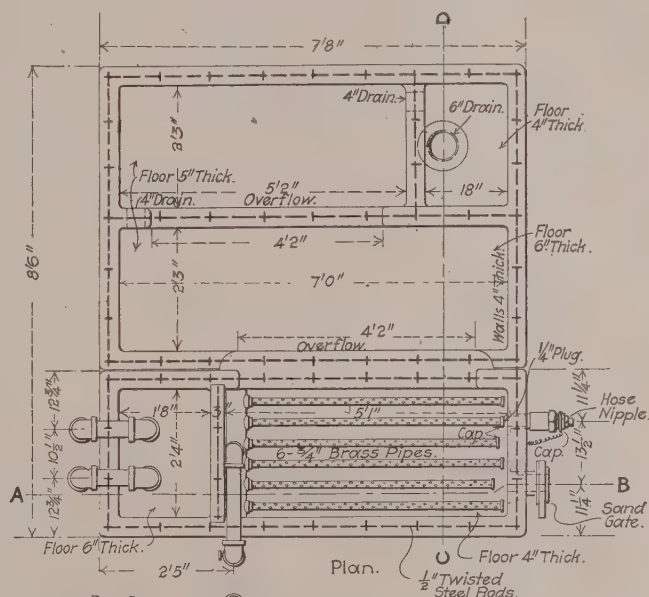
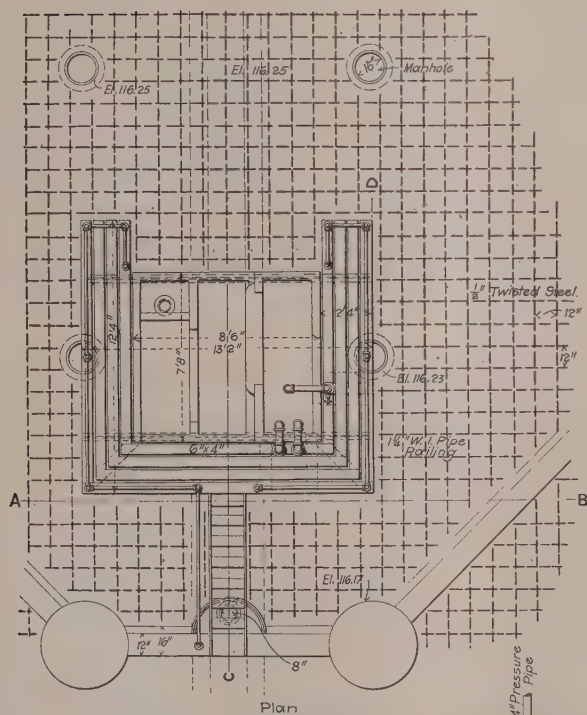
providing for a small water jet. The purpose of these is to throw the sand through a hose to the most distant parts of the court, in case this should prove necessary.

In the top of each of the walls supporting the sand washer is a 6-in. steel I-beam which projects 2 ft. 4 in. at each end to support a platform of 6x4-in. yellow pine planks laid flat.



furnishing water under pressure and removing the mixture of sand and water. The steel box is 16x32½ in. and 13 in. deep, with a hopper-shaped top section which adds 3 in. to the depth and 6 in. to each plan dimension. Oak bars thrust through staples riveted to two sides of the box provide means for carrying it. The ejector nozzles are on the longitudinal center line, screwed through flanges bolted to the opposite ends of the box, with their axis 4 in. above the bottom. A space of about 1½ in. separates the adjacent ends of the nozzles, which pass through a casting, to hold them to center, of the form shown on the detail drawing, the purpose of which form is to prevent the arching of the sand at the feeding place. Available water pressure and other conditions determine for each case the exact dimensions of the nozzles, but the discharge nozzle has the same proportions as the downstream cone of a Venturi meter. The nozzles are bored inside, and turned outside to take the casting which holds them to center.

From the pressure water pipe just before the valve controlling the supply to the nozzles, a



Sand Court and Sand Washer on Top of Filters; Details of Reinforced-Concrete Sand Washer.

means of the two trap chambers. Clean sand mixed with very little water can be drawn from the bottom of the first tank at the end opposite that at which the dirty sand enters, by opening a sand gate. Near this gate there is a 2½-in. hose connection, and in the cap at the end of the brass pipe inside the tank, in line with this connection, there is a ¼-in. screw plug

The platform is guarded by a pipe railing and access to it is had by means of an iron staircase leading up from the top of the wall around the sand court.

The portable sand ejector is a steel box containing a pair of ejector nozzles and a pair of pipes for supplying water to aid in the feed of the sand, with 2½-in. hose connections for

1½-in. pipe is taken off, which is carried over into the upper part of the box to a header, from which two ¾-in. pipes extend downward and along the bottom of the box, one on either side of the nozzles. Each pipe is capped and is punctured with seven ¼-in. holes along its bottom, staggered on either side of the lowest line. Through these two pipes water under practi-

cally no pressure is admitted to the bottom of the box, so as to keep the sand saturated to the level of the nozzles. At the middle of the bottom of the header of the $\frac{3}{4}$ -in. pipes there is a $\frac{1}{2}$ -in. nipple with an elbow fitted with a screw plug having a $\frac{1}{4}$ -in. hole bored through it. By this means a small jet of water will be squirted horizontally into the sand above the castings, so as to prevent the sand from being held up by them. These castings are the only obstacles to the downward movement of the sand, and every precaution has been taken to prevent obstruction. A valve in the $1\frac{1}{2}$ -in. riser enables the operator to throttle the pressure in these pipes to get the proper results, and a union in the horizontal run makes it possible to remove the pipes easily for cleaning when the holes become stopped. The sand is shoveled into the top of the box so as to keep it well filled. With 50 lb. pressure at the inlet 10 cu. yd. of sand can be moved per hour, and about 20 per cent. of the pressure at the inlet is recovered at the outer end of the discharge nozzle. Higher pressures at the inlet are advantageous if available. Repeated trials have shown that with this form of ejector only about one-half as much water is required as with certain older forms. This ejector was designed primarily for the Washington, D. C., filters, and was the outgrowth of experiments and tests made by authority of the late Col. A. M. Miller, engineer of the Washington Aqueduct. Several such ejectors have been made and thoroughly tested.

The other interesting part of this plant is the regulator house. In general it is so much like other regulator houses designed in Mr. Hazen's office and previously described that a detailed description here is unnecessary. The modification to provide entrance to the filters has already been alluded to and is clearly shown on the drawings reproduced herewith. It is worth while, however, to call attention to the Portland cement ceiling.

Construction was begun last July, and it is expected that the plant will be ready for use some time during the spring. Messrs. Hazen & Whipple, of New York, are the engineers, and the T. A. Gillespie Co., of New York City, the contractor. The total cost of the installation will be about \$40,000.

A WATER-POWER ELECTRIC GENERATING STATION is now being developed on the Housatonic River near Canaan, Conn., for the Berkshire Power Co., for the sale of power in Norfolk, Canaan and surrounding places. There will be a dam 98 ft. long and 8 ft. high, with arrangements for flash boards, and 41 ft. of the west end of the dam will contain three large waste gates. The power house will be located on the east side of the river and will be 63x37 ft. in plan. The dam, waste-gate walls, the building foundations and the flume will be of concrete, and the contract for their construction has been awarded to the Hartford Paving & Construction Co., of which Mr. Charles Crawford is manager. The steel roof trusses are to be furnished by the Berlin Construction Co., of Berlin, Conn., and the tile roof by the Ludevici Roofing Tile Co., of Chicago. There will be two 300-kw. generators, directly connected to a jack shaft, which will be connected to the water wheels by gearing. The water wheels will be set in two groups of four wheels each, making eight in all, although but six will be put in at present. They are to be of the vertical type, of 125 h.-p. each, made by the S. Morgan Smith Co., York, Pa. They will be set at the bottom of the flume and a vertical shaft will extend from each of them to bevel gears at the jack shaft. The work will be executed under the provision of Mr. W. S. Morton, as chief hydraulic engineer, and Mr. W. R. C. Corson, as chief electrical engineer.

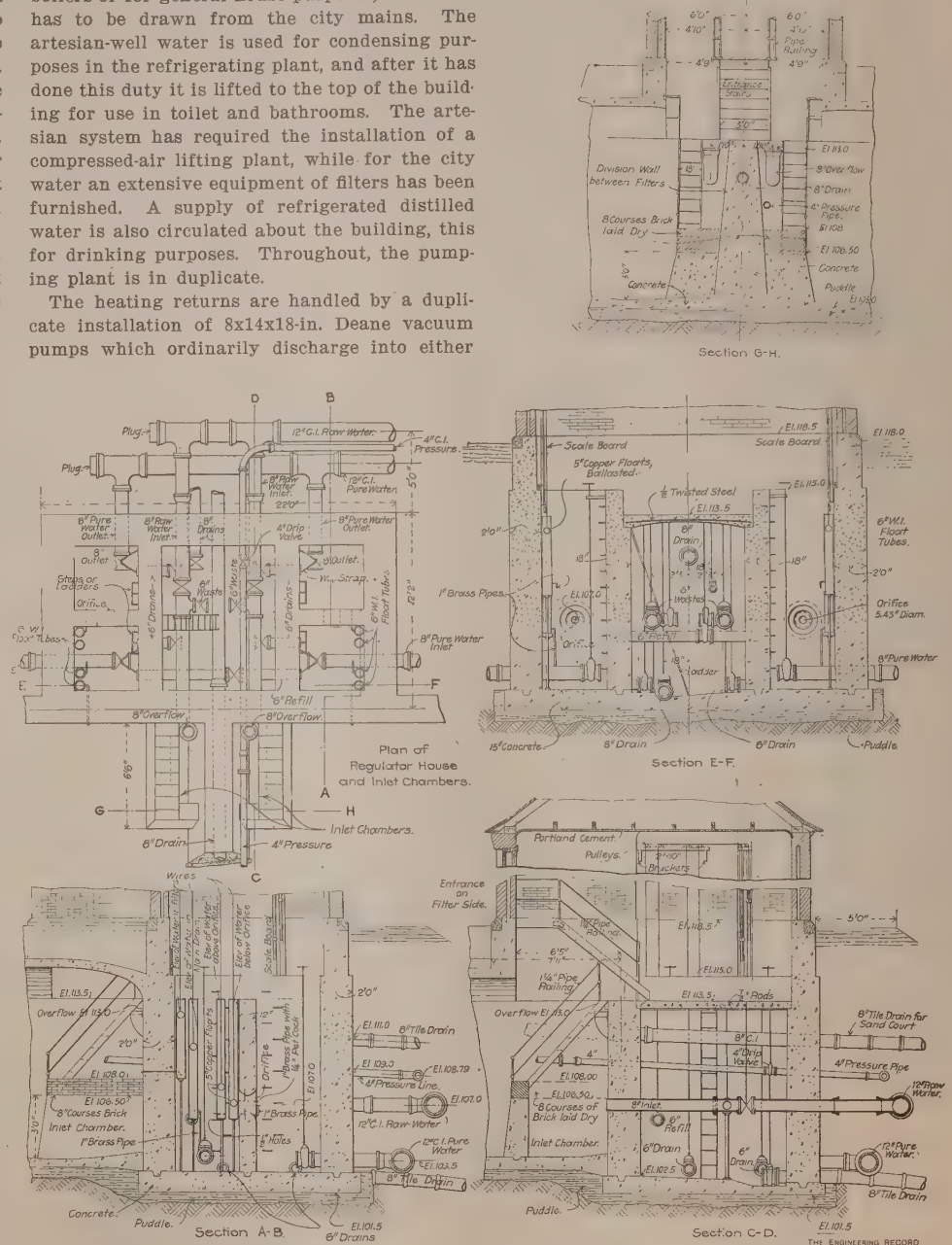
The Mechanical Plant of the Bellevue-Stratford Hotel, Philadelphia.—II.

Water Supply.—So far as possible water obtained from artesian wells on the site is utilized in the building, but this is unfit for either the boilers or for general house purposes, and water has to be drawn from the city mains. The artesian-well water is used for condensing purposes in the refrigerating plant, and after it has done this duty it is lifted to the top of the building for use in toilet and bathrooms. The artesian system has required the installation of a compressed-air lifting plant, while for the city water an extensive equipment of filters has been furnished. A supply of refrigerated distilled water is also circulated about the building, this for drinking purposes. Throughout, the pumping plant is in duplicate.

The heating returns are handled by a duplicate installation of 8x14x18-in. Deane vacuum pumps which ordinarily discharge into either

the other simply serves for connecting the far end of that main in case the nearer end is disabled in any way. Valves in that main provide for feeding some of the boilers from one direction and the rest from the other.

The artesian-well pumping plant is located in



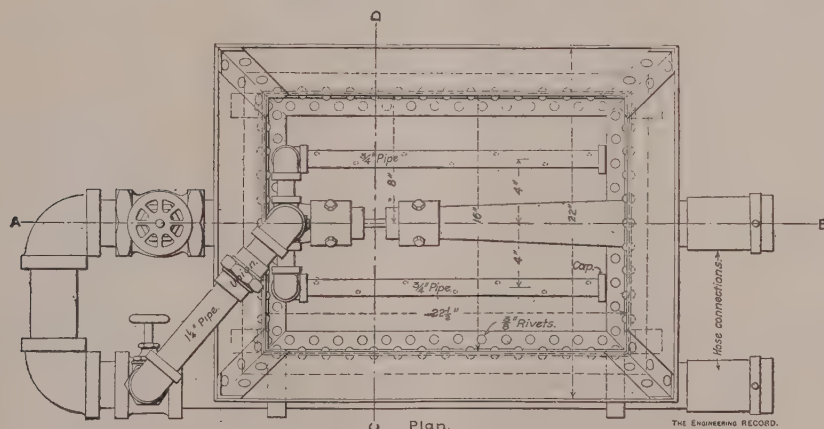
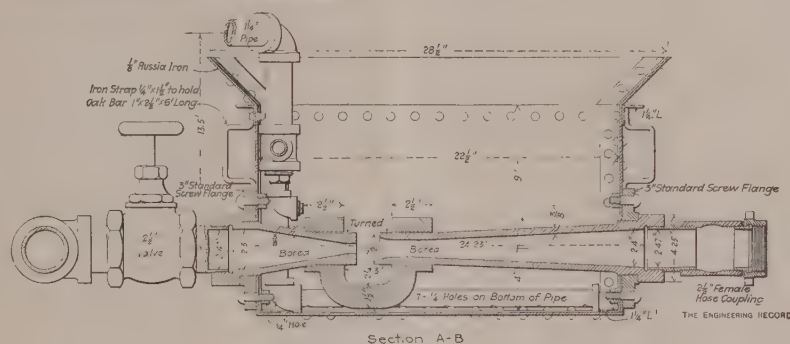
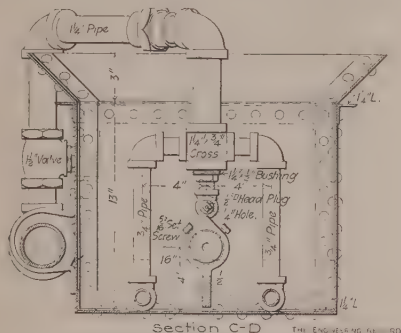
Details of Regulator House and Inlet Chambers of Filters at Poughkeepsie.

one of two 900-h.-p. feed-water heaters of the Cochrane type built by the Harrison Safety Boiler Works, these including arrangements for purifying the water. The heaters are of the open type and the boiler-feed pumps ordinarily draw their supply from them, the feed pumps being automatically controlled by the water level in the heaters. Three boiler-feed pumps are installed, each a $7\frac{1}{2}$ x5x6-in. Deane duplex pump, two being required for maximum load conditions, leaving the third as a reserve. They may also be connected on the suction side to a pair of tanks for holding filtered city water, but ordinarily this water is passed automatically through the feed-water heaters, when the return flow from the heating system is deficient. The feed pumps are connected into two discharge lines which are carried side by side to the far end of the boiler room and there joined together, forming a 4-in. boiler feed ring. The individual supplies to the boilers are all taken from one of these boiler-feed mains, so that

one end of the pump room that contains the feed pumps, feed-water heaters and vacuum pumps. Two of the wells are located at that point and ordinarily are calculated to supply all the water needed from this source. The third well, 80 ft. distant, has been driven as a reserve source. The water had to be lifted to the sub-basement floor and the air-lift method was adopted. The compressed air is furnished from a 10x10x10-in. Ingersoll-Sergeant steam-actuated compressor, and is stored in a tank nearby. The water is discharged into a tank in the same room, 8x8x6 ft. in size. From this it is handled by either one of a pair of $7\frac{1}{2}$ x4 $\frac{1}{2}$ x12-in. Deane pumps arranged to deliver to roof tanks through the condensers of the refrigerating system. As regularly operated one pump discharges the water through the ammonia condenser coils, from which it enters a tank, and from this it is delivered by the other pump to the attic tanks; in other words, one pump runs on low service and the other on high service. The pumps are

operated with speed controllers set to the desired number of strokes per minute. The forcing line to the attic tanks is 4 in. in diameter.

The city water is received through a meter in the mezzanine story of the pump room, where are also located two banks, each of four Loomis-Manning filters. Adjoining each of these banks is a filtered water tank. Underneath them are the house pumps and the feed-water heaters. The house pumps are of the compound type, 6x9x5½x12 in. in size, also installed in duplicate and delivering under automatic control to a



Details of Portable Sand Ejector of Filters at Poughkeepsie.

number of roof tanks. This water is largely for the supply to baths and for the house hot-water system. There are two hot-water generators located in the mezzanine of the pump room, each 4 ft. in diameter by 12 ft. long. They are connected in the usual way under the static head due to the height of the roof tanks, so that no pumping equipment is necessary for the hot-water service, but it is interesting to note that the cold water before reaching the hot-water generators is passed through cooling coils in the drip tanks. These tanks are intended to receive the oil-laden drips which must be discharged to waste but cooled before delivery into the sewers. The hot-water generators, which are practically Berryman feed-water heaters, set horizontally, are each arranged to receive both exhaust steam from the pumping equipment below and live steam, maintained at about 15 lb. pressure by means of a reducing valve. The pipes from these two sources join at a tee, from the third outlet of which the direct connection

is made to the generator. In each of the supply connections to the tee is a regulator, that in the live-steam line being of the Lawler type, and that in the exhaust-steam line of the Tagliabue type. When the water drops to a predetermined temperature the exhaust-steam regulator opens to admit steam to the coils of the generator, and if the demand for water is great or the exhaust steam is incapable of raising the temperature of the water sufficiently high, the Lawler regulator is set to admit live steam. Each generator is of 1,000 gal. capacity.

The remaining pump of the general water distribution system is the fire pump, which is a 1,000-gal. 18x10x12-in. pump which discharges into fire lines carried up through the building. A fire hose is provided opposite each fire line on every floor. The fire hose is hung in vertical folds from the Boyd pattern of swinging bracket, and both bracket and hose are enclosed in a wooden cabinet 2x3 ft. in size and 6 in. deep, so as to be at once convenient but inconspicuous.

The iced drinking water piped to certain parts of the building is supplied from the distilled water system. This service is controlled from

operated by a call bell system from the basement by placing a lever on a certain number which designates the floor on which the waiter is desired; the elevator will travel to the point designated and stop automatically, the system being handled by a man in the basement. The dumbwaiters travel at a speed of 300 ft. per minute. The diameter of the plungers on the passenger elevators is 7½ in., and the average water pressure is 140 lb. The plant was designed and installed by the Standard Plunger Elevator Co., of Worcester, Mass. There being fifty-three rooms on the fully-completed typical floor, one passenger elevator is supplied for every sixteen rooms per floor, or for the total number of guests' rooms, one elevator for two hundred rooms.

The elevator plant comprises three compound duplex Worthington pumps, operated under the control of Mason regulators to maintain a water pressure of 140 lb. They are 18x29x14x18 in. in size, and two are ordinarily sufficient to meet service conditions, leaving the third as a reserve. There are two pressure tanks, these supported on the mezzanine floor above the pumps, the gallery floor of the sub-basement being an iron grating. The two tanks are each 66 in. in diameter and 31 ft. long, exclusive of the bumped heads, and the usual air cushion is maintained above the water, a Westinghouse locomotive type air compressor being provided for this purpose. The discharge tank is located on the sub-basement floor near the pump, and is 14 ft. square and 7 ft. high. In addition to the main pumps, there is also a so-called jack pump, which is a 9x4½x12-in. duplex pump for heavy duty.

Refrigerating Plant.—The refrigerating plant is of 100 tons refrigerating capacity, supplying an ice-making tank of 10 tons output in 24 hours, some 40 odd refrigerators distributed around the building, and a freezer for 300 carafes. It is of the ammonia compression system, with arrangements for condensing and purifying exhaust steam as a source of the supply of water for freezing, and it employs a calcium-brine circulating system for distributing the refrigerating effect to the various refrigerator rooms. Two interesting details are that a three-pipe system of distribution has been installed for the brine so as to equalize the combined length of flow and return piping from the refrigerating plant to any refrigerator, and that the brine, after having performed its work in the refrigerators, is received into the ice-making tank, where it is cold enough to freeze the water. This tank serves as a suction storage tank for the brine-circulating pumps, which, of course, discharge through the brine coolers. The three-pipe distribution system is similar to the so-called loop system of electric lighting by which the effort is made to maintain the same potential across lamp terminals throughout; that is, the brine to a refrigerator at the base of the supply riser returns to a return line which is carried up the length of the supply riser, receiving other returns successively, and at the top turning over and dropping to the refrigerating apparatus at the bottom.

The refrigerating machinery comprises duplicate 50-ton machines, of the A-frame type, having a 16x30-in. horizontal steam cylinder with Corliss valve gear and two vertical 12x25-in. single-acting ammonia compressor cylinders. The compressed ammonia gas is condensed in a double pipe condenser supported above the floor in a mezzanine gallery. The condenser, it will be remembered, receives the water from the artesian wells, but may be supplied with city water at any time. The condenser comprises coils of 2-in. ammonia pipes enclosing 1¼-in. water pipes, and is designed to pass 50 to 75 gal. of water per minute for 50 tons capacity. There

a Deane 2x3-in. triplex pump belt-driven by a 1-h.p. General Electric motor. The motor is belted to the pump, the motor pulley being 5 in. in diameter, while the driven pulley on the pump is 45 in., making the ratio of speeds 9 to 1, or 50 r.p.m. for the pump shaft.

Elevator Equipment.—The elevator equipment is a notable installation of direct-acting plunger elevators having a long lift; there are eight passenger elevators, four of which run 286 ft., four freight machines, the longest single run of which is 294 ft., and eight dumbwaiters. Some of the dumbwaiters are direct plungers and others are of the hydraulic rope type. The passenger elevators are all built to carry a load of 3,000 lb. maximum and, at a speed of 350 ft. per minute, a load of 1,500 lb. On tests one of these machines was operated at a speed of 600 ft. per minute. The freight elevators are to carry 3,000 lb., with the exception of the heavy freight, which is raised by a jack pump, to lift a load of 6,000 lb. The dumbwaiters are

is the usual liquid receiver, and all the liquid ammonia is expanded in the brine coolers, except for a helical coil in the fore cooler or tank that holds the distilled water preparatory to its being run into the ice-forming cans. There are two brine coolers, one corresponding to each compressor, and these are of the Pontifex type, in which the ammonia space is that surrounding the brine coils. This construction of cooler is relied on as additional storage, for whenever the temperature of the brine circulated through the coils is insufficient to evaporate the liquid ammonia, the latter remains in the lower part as liquid, ready to meet a sudden rise in the temperature of the brine.

The distilling system for utilizing the exhaust steam is a usual one, comprising a grease extractor in the exhaust steam from the compressors, a condenser for liquefying the steam, a reboiler for driving off impurities and air, a skimmer by which the separation of foreign matter is effected, and two filters, connected in series, for further clarifying the water before it is sent into the fore-cooler. The grease separator for the exhaust steam is filled with coke, while the filtering material for the distilled water is of charcoal.

The freezing tank accommodates 160 cans 45x11x22 in. in size, each designed to form a 300-lb. cake. The usual automatic filler with flexible tube connection with the fore-cooler is provided, together with a thawing device by which warm water is sprayed against the side of the can and the ice cake dumped into an adjoining ice storage. For handling the loaded cans, a traveling crane spans the freezing tank, the crane carrying a Weatherson air hoist made by the American Bridge Works of Chicago. The freezing tank is about 21x23 ft. in plan and a feature of its construction is it is divided into two separate compartments, so that one side may be shut down for cleaning or repairing. As stated, it serves as a tank for the return of the calcium brine from the general circulating system, the inflow to each compartment being located at one corner and the outflow at the diagonally opposite corner. In order to maintain a level sufficient to keep the cans immersed, the outlet end to which the suction of the brine pumps is attached is provided with a dam over which the excess of brine flows. Otherwise there is no method for agitating the brine or for accelerating a circulation within the tank. There are three brine-circulating pumps of the Worthington type, 10x6x10 in. in size, each automatically regulated by means of a Foster valve in the steam supply. One pump is ordinarily used for the refrigerating apparatus in the lower part of the building, while another is working under the higher pressure that corresponds to the line of refrigerators in the service rooms on all the floors; they are all cross-connected and the pump in reserve may be employed for either service.

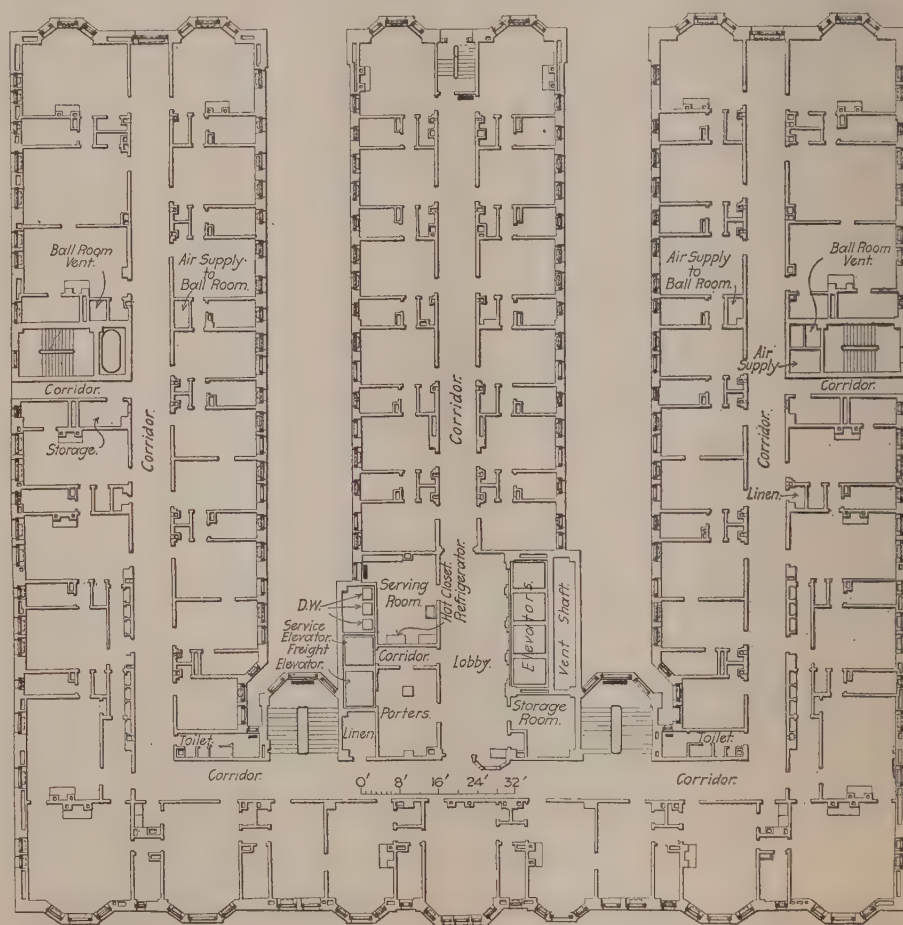
The requirements of the refrigerating plant so far as the refrigerators, cold-storage boxes and the like are concerned, cannot well be indicated in a few words, owing to the different conditions of exposure and the wide range of temperatures to be maintained in the different cold chambers. On the basis of the outside dimensions, that is, including the 6 or 8 in. of insulation, the total cubical contents of the refrigerated spaces amounts to 33,826 cu. ft. The various uses of the cold-storage boxes and the corresponding temperatures are as follows: Champagne, 26°; meats, storeroom for milk and butter, ice cream, 32°; oysters and clams, 34°; mineral water, pastry, beer, each of the boxes in the serving room on each room floor for milk, butter, etc., each 2 ft. 9 in., 4 ft., and 7 ft. in outside dimensions, 35°; fruit, butter and cheese pantry, 38°; flowers, 40°; vegetables,

42°; ale, 50°. There is also a 22x26x8.5-ft. room for the storage and cooling of garbage while awaiting time for incineration, and a 20x22x8.5-ft. room for sorting garbage, and both are designed to be kept at 35°. The entire refrigerating plant was installed by the Pennsylvania Iron Works.

Steam Heating.—The general heating of the building is arranged for by direct radiation, and the radiators throughout practically the whole building are hidden behind perforated screens and many of them are operated under thermostatic control. In connection with the main rooms, where either the occupation is relatively great or the character of it such that the change of air is necessary, there is an unusually elaborate system of ventilation, which has, as already mentioned, been extended to include many of the individual sleeping apartments of the hotel. The steam is distributed, except for the lowest stories, from a system of overhead

ation on the typical floor is approximately 3,850 sq. ft. The radiation in the rooms with a north exposure is proportioned in the ratio of 50 cu. ft. of contents to 1 sq. ft. of radiating surface, that in the south rooms in the ratio of 70 to 1, and that in the east rooms in the ratio of 60 to 1. The lower stories of the building are all provided with double double-hung windows, as a means of keeping out both noise and dust, the double windows being provided on the side streets up through the sixth story. On the fourth, fifth and sixth floors there is a slightly less amount of radiation as a result of the double-window construction.

The radiator enclosures are of wood, matching the interior finish of the room, and have a register opening at the bottom for the inflow of the room air to the radiator, this register having a height a little greater than the half height of the radiator and a width somewhat more than the length of the radiator. The



Plan of the Typical Floor of the Bellevue-Stratford Hotel, Philadelphia.

mains in the seventeenth story, with a ramification starting 14 in. in diameter at the exhaust riser, as already noted, with branches to dropping lines of pipe in the outside walls of the building, each pipe designed as a rule to supply two radiators on a floor. The distribution of steam is accelerated by the application of the Webster vacuum system, the system of return pipes from the thermostat valves on each radiator leading to a duplicate installation of vacuum pumps in the sub-basement.

On the typical floor there are about 140 radiators, one or two in each room underneath the window sill; one in every bathroom, similarly situated; one at the end of each of the wing corridors, which at that point have window light, and one in each of the stairway landings, which also have a window exposure. For this number of radiators there are some 81 dropping lines of supply pipe. The total amount of radi-

out-flow register is in the window sill. In the bathrooms the outlet opening of the register enclosures is placed in the upper part of the casing front, as the windows in those rooms are high, having fixed sills and allowing for high radiators. The inside of the casings are lined with ½-in. air-cell covering with No. 26 galvanized iron outside of the covering. Back of the register faces are mouse-proof registers. The radiators are operated by spindles extending through the front of the enclosures, and the valves are of the corner pattern. The Webster system gives control of the temperature of the individual rooms by throttling down the supply valves, and this and noiseless operation were among the reasons for adopting the system. The heating of the rest of the building is intimately associated with the ventilation and will be referred to in the discussion of the systems for air supply.

Besides the 14-in. main in the seventeenth story, there is a 7-in. main in the sub-basement for the lower floors. The heating system is, of course, arranged to receive live steam when necessary, and the live-steam connection is made from the 12-in. steam loop in the engine room by means of a 5-in. connection, which is expanded through reducing valves to 12 in. in size and joined into the 18-in. exhaust riser beyond the connection from the muffler tank. Two pressure-reducing valves are employed in series, as it was not considered wise to count on one valve to reduce from the high pressure of the boilers to the low pressure of the heating system. In this horizontal live-steam connection is taken the 7-in. sub-basement heating supply, with a valve on each side of its junction with that connection. With one of these valves closed, the lower part of the building could be supplied with live steam only, or with the other closed could be connected directly to the exhaust heating system, or with both open could receive part of the low-pressure live steam that would be passing to the exhaust riser.

Owing to the height of the building, provision was necessary to compensate for changes in length of the dropping lines of the steam-heating supply pipes with expansion and contraction. Expansion loops were adopted of the form shown in an accompanying sketch. In order to limit the movement to the highest practicable degree, the expansion loops were furnished at the fourth, eighth and twelfth floors, or at distances of 40 to 45 ft., and the vertical pipes were anchored at intermediate points, so that the movement in those lines is that due to the expansion in half the length stated. At the anchors the supply and return connections are carried out in direct lines to the radiator, while at the points between anchors and expansion joints, the supply pipe is carried in a loop to the radiator in order to eliminate movement at the radiator itself.

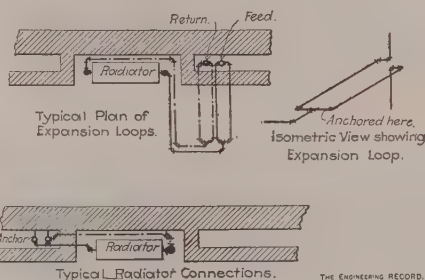
In connection with the steam-heating system some of the proportions between the heating surface and the cubic contents may be of interest in the case of the Turkish bath rooms in the basement. Three of the rooms, the Turkish room, the Russian room, and the rubbing room, are grouped together in an interior position, so that the transmission of heat from them takes place through walls which are exposed on the outer surfaces to the normal temperature of the basement rooms. They are warmed by pipe coils hung around the upper part of the walls. The Turkish room, which is approximately 8x11.5 ft. in plan, contains three return bend-coils each containing three pipes, and altogether presenting 93 sq. ft. of surface. The room has a volume of about 782 cu. ft., so that the ratio of contents to heating surface is 8.4 to 1. A supply of air from the ventilating system is delivered to the room. The Russian room contains about 56 sq. ft. of pipe coil surface on the walls and 6.6 sq. ft. under a slab seat, and the ratio of contents to total radiation is 12 cu. ft. of space to 1 sq. ft. of coil surface. The rubbing room contains 65 sq. ft. in wall coils and 10 sq. ft. under three slabs, making the ratio in this case 21 to 1.

Miscellaneous.—Under the head miscellaneous have been grouped the equipment for the pneumatic-tube services, the equipment for the carpet-cleaning apparatus, and the system necessary for raising into the public sewerage system the sewage collected in the lower part of the building. The pneumatic system was installed by the Lamson Consolidated Store Service Co., of Boston, and includes some 6,000 ft. of tubing 2¼ and 3 in. in diameter. Compressed air for this installation is furnished from a class H 8x14¼x8-in. Ingersoll-Sergeant duplex

steam compressor with an auxiliary in the shape of a 10x16x18-in. Knowles direct-acting steam compressor. There are two reservoir tanks for the storage of the compressed air, each 5 ft. in diameter and 12½ ft. long. The pneumatic tube system is arranged so that 25 lb. pressure is automatically maintained on both tanks. A pipe is led from these to a separate tank, for the temperature control system, no separate pumps being required for the latter. The pressure for the temperature control is 15 lb. There are about twenty stations for both sizes of tubes, mostly located, one in the serving room and the other at the floor clerk's office on every floor. The carriers are forced through the tubes at a speed of about 25 ft. per second.

The sewage lift comprises four Shone ejectors which are supplied from a duplicate installation of 5x7x7-in. compressors built by the American Compressor Works, of Brooklyn. The Kenny system of carpet cleaning is that contemplated, and while the piping has been put in throughout the building, the exhausting apparatus has not yet been installed.

The steam piping throughout the plant is of wrought iron (the specifications prohibiting steel pipe altogether), with extra heavy flanges and fittings for the high-pressure lines. The covering throughout is of nonpareil cork of the sectional type. For the high-pressure lines it is 1½ in. thick, with asbestos paper lining to prevent the charring of the cork, and heavy duck wrapping with lacquered bands over sec-



Radiator Connections with Risers.

tion joints. For valves, fittings and flanges of the high-pressure system, moulded or blocked cork covering was employed. For the rest of the piping the cork covering was 1 in. in thickness.

The hotel was built from the plans of Messrs. G. W. & W. D. Hewitt, of Philadelphia. The design of the entire mechanical equipment was placed in the hands of Francis Bros. & Jellett, Inc., Philadelphia, including the steam, refrigerating and electrical installations. The contractors for the several divisions of the work have already been mentioned in some cases. The steam piping, steam heating and the ventilating plants were installed by the L. H. Prentice Co., of New York, and the electrical layout by the George A. Fuller Co., New York, which was also the general contractor for the entire building. Mr. Wm. P. Ogelsby, of Philadelphia, was the plumbing contractor. Mr. B. F. Stevens, of Messrs. Hewitt, had direct supervision over the preparation of the plans and details of the work described, while Messrs. Wm. G. Snow and R. C. Morgan had charge of the design of the piping work, heating and ventilation and of the electrical work, respectively, for Messrs. Francis Bros. & Jellett.

(To be continued.)

A WATER-LEVEL INDICATOR is in use in the generating station of the American River Electric Co., California, a ball float at the head-works actuating the core of a solenoid and in turn a station ammeter.

Difficulty with the Ground Water Drains of a Building.

The inability of the underdrains of the New York Stock Exchange building in New York to handle ground water collecting below the cellar level was a condition discovered some time after the building was completed. The exudation of moisture began to make itself very evident at various points on the inside of the brick walls of the cellar. It appeared that not only had the underdrains become clogged but the suspended matter in the water was deposited in the discharge pipes from the drainage pumps which had to be cleaned at very frequent intervals, the material usually hardening so that its removal was not particularly easy. Meanwhile the wet areas in the walls began to grow.

The building below the street level has on all sides a permanent cofferdam of concrete 8 ft. thick and the space within is occupied by four stories of the building, which was carried 54 ft. below the New St. curb, or 42 ft. below the ground water level. The cellar floor was built of concrete and inside of the cofferdam were erected the brick walls, the concrete floor and the lower 18 in. of the brickwork being provided with waterproofing. A space of 4 to 6 in. was left between the brick walls and the cofferdam, and the ground water, it was expected, would flow into a sump at a central point in the cellar through an extensive system of drains under the cellar floor. From the sump the water would be pumped into the sewer. It has since been discovered that these drains have practically become stopped up, the water appearing at various points along the walls at these points, which were immediately above the waterproofing line, and accumulations of cream-colored mud removed.

Analyses showed the material to consist largely of carbonate of lime, 4.5 gr. per gallon; calcium sulphate, 6 gr.; sodium sulphate, 19¼ gr.; sodium chloride, 6.8 gr.; silica, 0.8 gr.; iron and aluminum oxide, 0.5 gr.; magnesium carbonate, 0.08 gr.; and organic matter, 0.7 gr. After a considerable discussion, Mr. John H. Dally, chief engineer of the building, concluded that the depositions might be caused by a saturated condition of the drainage water, and this assumption is thought to be correct as now the water is being successfully pumped by adding water to the contents of the sump. At any rate it is now found that only a slight deposit is found on the discharge pipes to the sewer, while piping previously in use practically clogged up in three months time. The underdrains having become stopped up, a trench was built in the cellar floor extending from the space between wall and the permanent cofferdam to the sump, and wooden frames provided with wooden doors were fitted to the openings made in the walls. These are spaced along the walls at distances of 8 to 10 ft., and after the removal by hand of such deposits as fail to flow to the trench, water can be introduced by means of a hose. Drains from certain plumbing fixtures in the building as well as circulating cooling water from the air compressors are discharged into the sump, so that a special supply of fresh water from the street mains is not necessary. One sump pump is kept constantly in operation.

CONCRETE COAL BUNKERS have been provided for the Dunfermline power station of the Fife Electric Power Co., Scotland. The bunker is built against the side of an embankment on the top of which is the railroad siding, and by means of concrete chutes the coal is delivered to the bunkers. The bunker outlets on the lower side of the bunkers deliver to small cars on a narrow-gauge tracking.

The Power Station of the Amsterdam-Haarlem Electric Ry.

The first electric railway in the Netherlands was built about five years ago in Haarlem. In addition to a belt line about that city, it had branches to Bloemendal and Zandvoort, the latter a seaside resort 5 miles distant. About four years ago concessions were obtained for a line to Amsterdam, 10 miles from Haarlem, running for a part of the distance over a national highway and for about 2 miles over private right-of-way. Running rights were secured over the tramways in Amsterdam, then in process of conversion to electric lines, and permission was obtained to build $1\frac{1}{2}$ miles additional track in Haarlem. When these arrangements had been made, Mr. H. J. Pierce, of Buffalo, decided to build and operate the system, and a Dutch company was accordingly organized for the purpose, all its shares being owned by the Netherlands Tramway Co., of New Jersey, while the bonds were taken by Amsterdam bankers. J. G. White & Co., Ltd., of London, were engaged as the engineers and contractors for the entire system, including the reconstruction of the old lines as well as the building of the new portions, including track and overhead construction, power station, car house, shops, office buildings and the revetment of the canal side of the government highway. Many features of this work are of much interest, but it is proposed to confine this article to the power station, as a type of structure constructed on very poor foundations.

The power house is situated in a central position at Halfweg, midway between Amsterdam and Haarlem. It is in practically the best position for distributing power to the line, being

foundations in the manner indicated in the illustrations.

The buildings, which include the station and car-house, are of brick, substantially and neatly finished with stone trimmings. The ground area occupied by the power station site itself is about 9,150 sq. ft., with sufficient ground for future extensions. A wharf is erected 26 ft. 3 in. wide, and immediately adjoining is the boiler house, which is 88 ft. 7 in. x 52 ft. 6 in. A division wall separates the boiler and engine rooms. The engine room is 59 ft. x 34 ft. $7\frac{1}{2}$ in., and is 21 ft. 4 in. high from engine room floor to top of wall. Situated at the end of the boiler

pals. The whole of the slopes are covered with red tiles secured to a wood lining which is fastened to the purlins. A monitor is formed along the full length of the boiler house, which is 9 ft. 10 in. wide, each side being filled with nine rows of louver boards supported at intervals by intermediate fittings. Wooden gutters with zinc linings are provided along the tops of the walls, with suitable drain pipes to carry off the water to the ground level or to a tank placed on the roof, in which the water is stored for washing purposes. Good light is obtained throughout the entire building by large glass windows with iron frames, and ample door



Power Station of the Amsterdam-Haarlem Electric Railway.



Boiler Room of Amsterdam-Haarlem Power Station.

located on the banks of the Ringvaart Canal, which will afford cheap carriage for coal and other supplies, and has an abundance of water for feed to boilers and jet condensation. Owing to the nature of the country and the poor condition of ground at the site of the power station, an elaborate arrangement of piling was necessary for the foundations. The piles are $9\frac{3}{4}$ in. in diameter and 46 ft. long, placed 4 ft. 1 in. apart. Each is rated with a capacity of 4 tons. They are capped with $7\frac{7}{8}$ x $9\frac{3}{4}$ in. timbers, running the entire length of the building and supporting a 3-in. floor. The piles are cut off 3 ft. 7 in. below water level, and carry the

room is a coal storage room, which is 50 ft. 8 in. x 35 ft. 4 in., with storage capacity for 400 tons. An outhouse for offices communicates with the engine room, and is 12 ft. 9 in. x 12 ft. $9\frac{1}{2}$ in. The walls of buildings are 14 in. thick above and 21 in. thick below the ground line, the walls being supported by pilasters 14 ft. 9 in. apart and 21 in. thick, which are carried to the top of walls for supporting the roof principals.

The principals are of tee section rafters with angle struts and flat bar ties securely riveted to suitable plates. The purlins are of channel iron, with wooden runners, and are supported by angle iron brackets fastened to the princi-

pal space is provided for bringing machinery into the building.

The boiler house contains six Lancashire steel boilers, $7\frac{1}{2}$ ft. in diameter and 27 ft. 10 in. long, by Stork, of Hengelo, Holland. Each boiler contains two 2-ft. furnaces, each flue having five Galloway tubes, the heating surface of each boiler being 926 sq. ft.; grate area, 35 sq. ft.; steam pressure, 160 lb. per sq. in. The foundations consist of brick arches filled with sand and the boilers are encased in heavy brickwork walls 1 ft. $9\frac{3}{4}$ in. thick and supported on cast-iron stools.

The feed-water to the boilers is taken from the adjoining canal, which contains an amount of suspended matter necessitating the filtering of the water. Under the boiler room floor, in front of the boilers, a duplicate set of tanks is situated, built of brick. Each set consists of a filter tank with reservoir, the filtering medium consisting of sand and clinkers, supported on a wooden floor perforated with holes, thus allowing the water to percolate through the medium to the reservoir. A branch pipe connecting both reservoirs leads to a hot-well. Inside of the hot-well and fixed to the side of the tank is a ball float valve, with connecting pipe to the water inlet supply to the condensers, the latter being used as an automatic emergency water supply in the event of the filtering tanks failing to supply the hot-well. The area occupied by the filter tanks is about 710 sq. ft.

A vertical exhaust feed-water tube heater 9 ft. 7 in. high x $24\frac{1}{4}$ in. diameter, made by the Wheeler Condenser & Engineering Co., is placed directly behind the feed-pumps, the feed-water entering at the bottom and leaving at the top, the exhaust steam vice versa. Three direct-driven horizontal duplex end packed feed pumps, $6 \times 3\frac{1}{2} \times 6$ in. made by the Buffalo Pump Co., are installed, each capable of delivering 2,400 gal. per hour against 300 lb. per sq. in.,

the working steam pressure being 160 lb. per sq. in., each unit being capable of supplying the total amount of feed-water to the boilers.

The feed-water piping to boilers is arranged in duplicate. The discharge from the pumps passes through the heater into one of two mains, which run along the side onto the top of the boilers and branch off to a Y piece into the feed-check valve in front of the boilers. By an arrangement of valves, the heater can

temperature of 500° Fahr. By means of flue doors the superheaters can be cut out and engines worked by saturated steam. The heating surface of each superheater is 330 sq. ft. Each superheater consists of ten rows of coils, the ends of which terminate in two cast-steel headers, 8 ft. 11½ in. apart, the coils being bound by steel straps bolted together. The steam enters the one header, passes through the tubes and discharges at the other. Fixed to

piles 46 ft. long, placed on 2 ft. 2 in. centers.

The main engine plant consists of three Bel-liss patent self-lubricating, three-crank, triple-expansion engines, each of 430 b.h.p. at economical cut-off, and having a steam consumption of 13½ lb. with superheated and 17 lb. with saturated steam, with 26-in. vacuum. The speed is 375 r.p.m., and its regulation is within 3 per cent., even with sudden variations from full to no load. The engines are of the enclosed type, supported on a heavy cast-iron frame and secured by nine foundation bolts. The cylinders are 12-in., 17-in., and 26-in. x 13-in. stroke.

The foundations for the main engines and condensers are built of concrete, the engine centers being 14 ft. 9 in. apart. Surrounding the engine and condenser foundations are concrete arches supporting the engine-room floor. The latter consists of tiles bedded in concrete and supported on two layers of brick, laid in turn on sand.

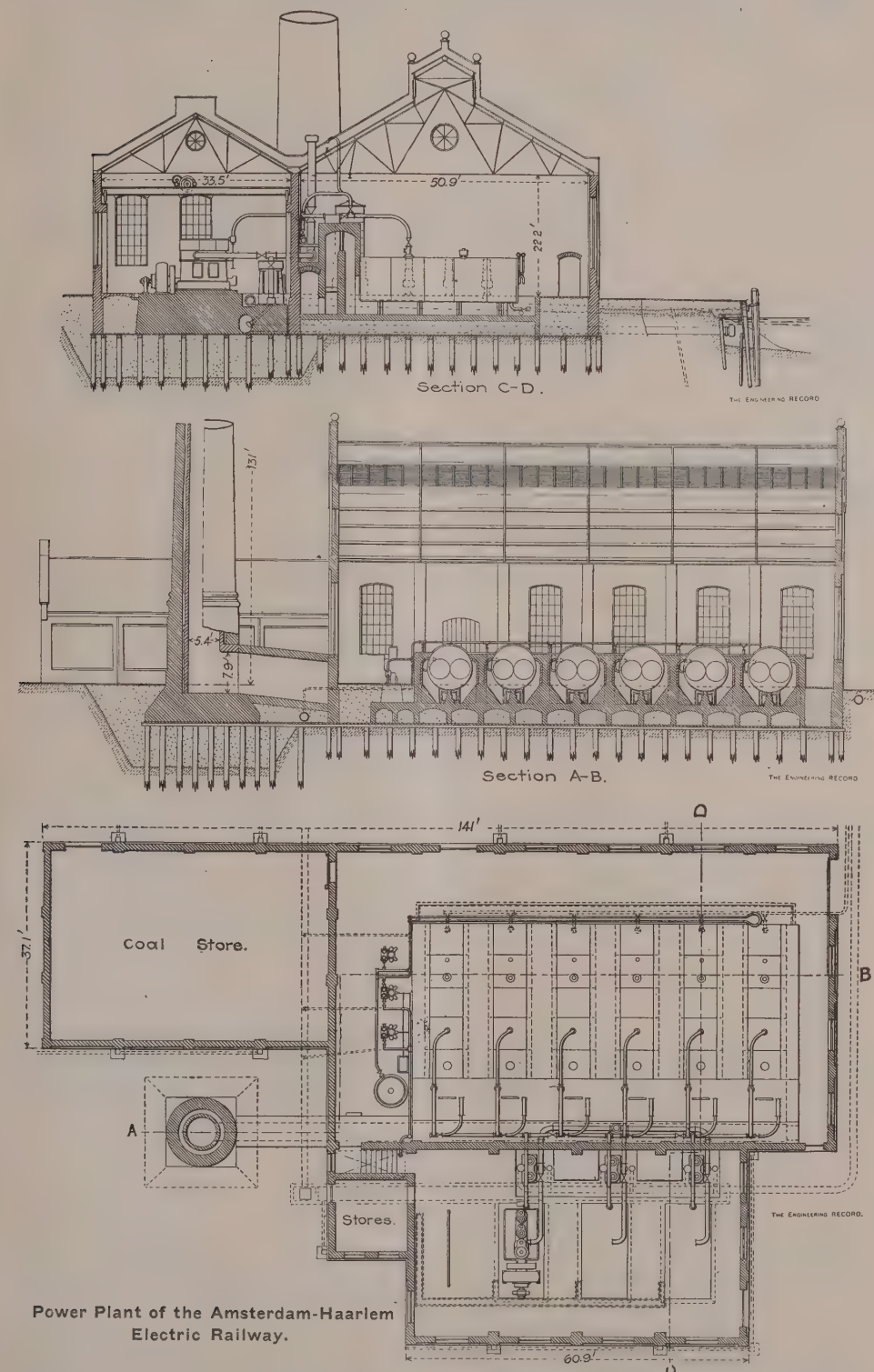
The condensing plant for the main engine, made by the Nederlandsche Fabrik, Amsterdam, consists of three jet condensers, each capable of condensing 9,000 lb. of steam per hour. The pumps are of the vertical type, the cylinders being placed side by side, supported by a cast-iron frame. Directly below are the pumps, of the Edwards type, each set being secured by six foundation bolts. The condenser and injection water inlets are situated behind the pumps, the pumps discharging into a large air vessel placed in front of the pumps.

A 10-ton overhead hand traveling crane, constructed by Louis Smoulders & Co., spans the engine room, the span being 32 ft. 4 in. The motions, hoisting and traveling, both longitudinal and transverse, are worked by means of band chains from the engine room floor.

From the angle stop valves on the boilers 6-in. pipes join the cast-steel header of the superheater, and then branch into the main header, from which the engines take their supply of steam. The piping, which is extra heavy throughout, is arranged by closing valves in the main header, to permit the operation of this plant as three independent units. Owing to the high temperature of steam, ample allowance has been made for expansion and contraction, and the piping designed in such a way that any condensation of steam in pipes connecting the main header terminates in the main header, and is drawn off by three drains of large size, one in each section, so as not to permit of any accumulation of water in the pipe. The three drains being coupled to two steam traps, which can be worked independently, discharge into a drip main which runs along the division wall to the hot-well. A standpipe from the drip main is placed in a prominent position in the boiler house, with end open, so that any excessive discharge of steam will show at once a defective trap. The main header is 8 in. in diameter, the pipe from the stop valve to the superheater is 6 in., that from the superheater to the main header 4½ in., and that from the main header to the engine 4½ in. All steam piping was installed by Seiffert & Co., Berlin.

From each of the angle stop valves on boilers, a drain is connected to a drip main which discharges into the hot-well. This drain will only be used in the case of any of the boilers being shut down, so as to prevent any water from accumulating in the valve.

The auxiliary units (feed-pumps and jet condensers) are worked with saturated steam taken from branches off the main steam pipe, between stop valves and superheaters, and the piping is a loop system, alternate boilers connecting one side of loop. From the loop a main is taken, in which a separator is fixed,



Power Plant of the Amsterdam-Haarlem Electric Railway.

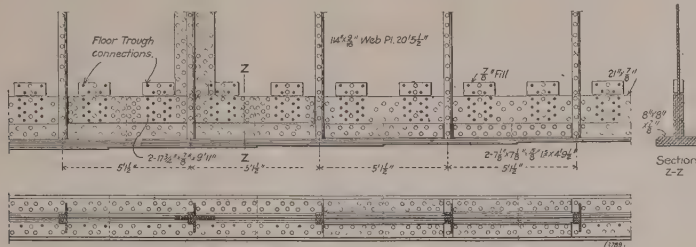
be cut out and the water pumped direct to the boilers. The piping is arranged so that one or more boilers can supply any one engine independently of the others, and allow the consumption of steam in the engine to be determined at any time.

There are six superheaters, by Stork, of Hengelo, Holland, which are placed in flues directly behind boilers, and are arranged to work at a

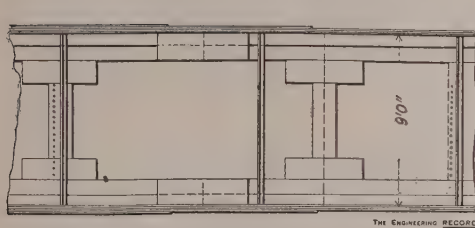
the discharge steel header is a 1½-in. safety valve, a 1-in. blow-off cock, and two small holes for testing purposes.

A round brick chimney is situated free from the building at the end of the boiler house, being 131 ft. high by 5 ft. 5 in. diameter (internal). It is lined with firebrick set in fireclay to a height of 65 ft. The foundation is a 6-ft. bed of concrete 23 ft. square, carried on 9¾-in.

Harvard Bridge, Boston, is a very heavy highway structure with twenty-five spans, including ten 75 ft. $2\frac{1}{2}$ in. long. These have four main lines of deck plategirders with horizontal top flanges and inclined bottom flanges. They are

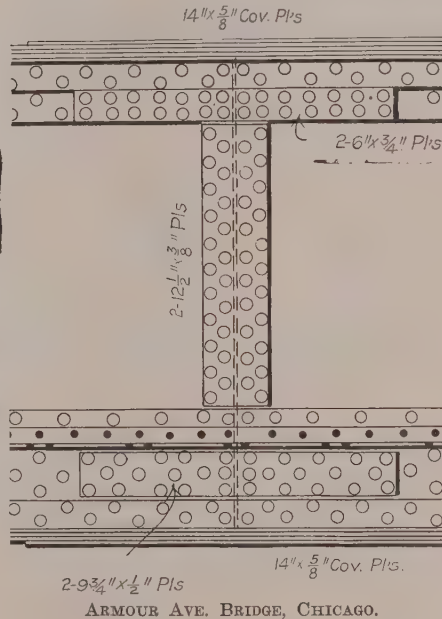


BRIDGE ON CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS RY.

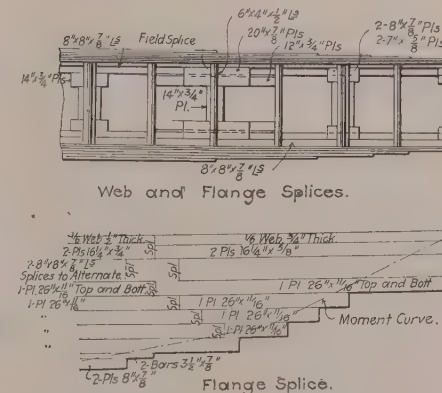


RANKINE BRIDGE.

BRIDGE 7, BRADFORD DIV., ERIE R. R.



ARMOUR AVE. BRIDGE, CHICAGO.



BRIDGE 76, LEHIGH VALLEY RAILROAD.

Details of Web and Flange Splices in Plate-Girder Bridge Construction.

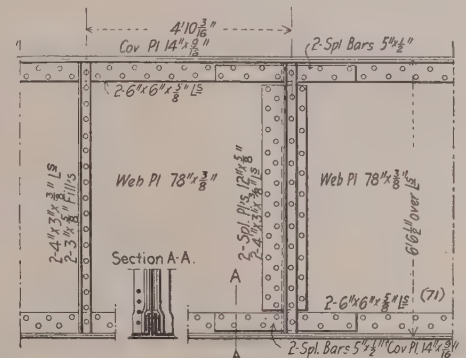
8 ft. deep at the piers, 5 ft. deep at mid-span, and are made with $\frac{3}{8}$ and $\frac{7}{16}$ -in. plates 5 ft. long, web-spliced with double $7\frac{1}{2} \times 7/16$ -in. cover-plates with two vertical rows of rivets. The flanges have pairs of 5×5 -in. angles with a maximum of four thicknesses of 16-in. cover-plates,

and are spliced with $4\frac{1}{2} \times 4\frac{1}{2}$ -in. cover-angles about 3 ft. long, which are staggered on opposite sides of the web, and together serve for the two joints. The cover-plates are spliced by the overlapping ends of the top-plates and by 16-in.

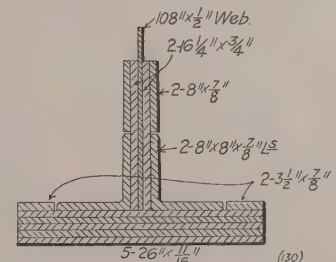
The 110-ft. 9-in. double-track, through span of bridge No. 76 of the Lehigh Division, Lehigh

Valley R. R., has two plate-girders 9 ft. deep, with web-plates about 10 ft. long and $\frac{1}{2}$ and $\frac{3}{4}$ in. thick. The maximum flange section consists of two $16\frac{1}{4} \times \frac{5}{8}$ -in. side-plates, two $8 \times 8 \times \frac{7}{8}$ -in. angles and five $26 \times 11/16$ -in. cover-plates, two $8 \times \frac{7}{8}$ -in. and two $3\frac{1}{2} \times \frac{7}{8}$ -in. bars. The web has seven shop-riveted splices, each made with a pair of cover-plates 14 or 21 in. wide, and with two pairs of horizontal $14 \times \frac{3}{4}$ -in. cover-plates at the upper and lower ends of the girder-plates for the three middle splices, which are entirely clear of the web flange-plates. At the ends of the girders the upper and lower horizontal web-splice plates are made, each with two pairs of $8 \times \frac{7}{8}$ -in. and $7 \times \frac{5}{8}$ -in. plates. The girder was shipped in three pieces and the two field-riveted web-splices were made similar to the shop splices, except that the horizontal plates were longer, so as to splice the web flange-plates also. At these points the staggered flange joints were spliced with a pair of $8 \times 8 \times \frac{7}{8}$ -in. angles, two $20 \times \frac{7}{8}$ -in. and two $12 \times \frac{3}{4}$ -in. side-plates, besides the projecting ends of the horizontal cover-plates, which were arranged as shown in the diagram to enable the sections of the girder to be kept separately and conveniently matched in the field. At these points the splices provided for 245,600 lb. shearing stress and 100,218,000 lb. bending moment.

The four 69-ft. girders of the three-track Armour Ave. crossing of the Chicago Junction R. R. are 87 in. deep and have the webs made in three lengths, shop-spliced with pairs of vertical $12\frac{1}{2} \times \frac{3}{8}$ -in. plates and four rows of vertical rivets. The 6×6 -in. flange angles are reinforced by 14-in. cover-plates and by 12-in. side-plates for the top flange, and $22\frac{1}{2}$ -in. side-plates for the bottom flange. The first bottom cover-plate is 20 in. wide to afford special floor connections. The flange-angles and plates are made in single lengths without splices, and the appearance of splices in them is due to the use of cover-plates over the lower part of the side-plates to com-



KINZUA VIADUCT, ERIE R. R.



Section of Outside Girder at Center.

plete the web-splices and provide for the horizontal stresses assumed to be carried by a fraction of the sectional area of the web.

The center girder of the 116-ft. double-track, through span of bridge 454 of the New York Central & Hudson River R. R. has shop-riv-

eted flange-splices designed to secure a minimum rivet length of less than 5 in.

The girders were 10 ft. deep from back to back of flange angles, and about 11 ft. deep over all. The bridge was proportioned for a live load consisting of two 142-ton locomotives followed by a train load of 4,500 lb. on each track, and was built of medium steel sub-punched and reamed. The girders were built according to the New York Central & Hudson River R. R. standard specifications, and the moments required a heavy maximum flange section, which was made with a gross area of about 152 sq. in. It was built up with a T-shape from a pair of the heaviest angles attainable namely, 8x8x1 $\frac{3}{8}$ -in., two 18x11/16-in. vertical side plates, and five 24-in. cover-plates, with a combined thickness of 3 $\frac{3}{8}$ in. The flange-angles were each made in three pieces with planed butt joints staggered about 4 $\frac{1}{2}$ ft. apart at web-stiffener points on opposite sides of the web, the center of each pair being about 29 ft. from the center of the girder. Both flange-angle joints on opposite sides of the web and at the same end of the girder were spliced by the same pair of 6 $\frac{3}{8}$ x6 $\frac{3}{8}$ x $\frac{7}{8}$ -in. cover-angles about 10 $\frac{1}{2}$ ft. long, which were planed down from 8x8-in. angles and rounded so as to exactly fit inside the 8x8-in. angles and have their edges flush. The rivets through them had a grip of 55/16 in., which was 9/16 in. less than if they had engaged the center cover-plate, which did not quite reach to the splices. The flange side-plates were spliced about 21 ft. each side of the center of the girder, where their thicknesses changed from 9/16 to 11/16 in. These splices were made with 10-in. plates on their upper edges and with 6 $\frac{3}{8}$ -in. plates on top of the flange-angles over their lower edges. The girder webs varied in thickness and were spliced at every third panel, about 14 ft. 3 in. apart, by double cover-plates with four or six vertical rows of rivets, corresponding to the varying shear. The web splice plates terminated at the side-plates, and therefore did not splice the lower outer edges of the webs, which were not considered in calculating the flange area. The flange cover-plates were arranged without any splices, except for the full length ones next the angles, which were spliced by the projecting ends of the next ones outside. Some of these latter, 24x11/16-in. plates, were made as much as 85 ft. long, to avoid splices. The flange-angles and cover-plates were assembled and reamed before being riveted to the webs; and all rivets were driven by pneumatic pressure machines, care being taken to hold onto them until they were cooled to a dark color before releasing the pressure in the jaws of the machine.

The 105-ft., double-track, through span of the Chicago, Cleveland, Cincinnati & St. Louis R. R., near Worden, Ill., has plate-girders 9 ft. 6 $\frac{1}{2}$ in. deep, back to back, of flange-angles. Each web has five shop-riveted splices made with a pair of cover-plates and six vertical rows of rivets. The flanges have opposite top and bottom splices staggered on opposite sides of the web in adjacent panels. The flanges have 8x8x $\frac{7}{8}$ -in. angles from 15 to 61 $\frac{1}{2}$ ft. long, spliced with single 7 $\frac{1}{8}$ x7 $\frac{1}{8}$ x $\frac{5}{8}$ -in. cover-angles 4 ft. 9 $\frac{1}{2}$ in. long. The 21x $\frac{7}{8}$ -in. side flange-plates each have two splices made with 17 $\frac{3}{4}$ x $\frac{7}{8}$ -in. cover-plates nearly 10 ft. long, serving the joints on opposite sides of the web. The flange cover-plates were made in full-length pieces without splices.

The 128 $\frac{3}{4}$ -ft., single-track, through bridge No. 7 on the Bradford Division of the Erie R. R. has plate-girders 9 $\frac{1}{2}$ ft. deep, with special H-shape top and bottom flanges, each made with four 6x8-in. angles and several 20-in. cover-plates, giving maximum gross top and bottom cross-sections of about 79 and 85 sq. in. respec-

tively. The flanges have two shop-splices made with 6x8-in. cover-angles over the staggered joints. The flange cover-plates are spliced by the projecting ends of the outer plates. The webs are spliced by pairs of cover-plates clearing the flanges and by pairs of horizontal 11-in. plates riveted over the webs of the flange angles.

The 87 $\frac{1}{2}$ -ft. x 8-ft. plate-girders of a single track deck span of the Grand Trunk R. R., Canada, are unusual on account of the different cross-sections adopted for the top and bottom flanges, and for the odd sizes of the angles rolled in European mills. The H-shape top-chord flange has four 8x4 $\frac{1}{2}$ x $\frac{3}{4}$ -in. angles and two 14x $\frac{3}{4}$ -in. web plates throughout, and is reinforced in the center by two 7x7/16-in. web cover-plates 27 ft. 4 in. long. There are no horizontal flange cover-plates, and the upper surfaces of the top flanges are free of rivet heads which would be obstructions for the tie seats. The flange-angles are made in three sections with their joints adjacent to each other on opposite sides of the web, and spliced by 7x3 $\frac{1}{2}$ x $\frac{5}{8}$ -in. cover-angles 33 in. long, planed to fit their fillets. The flange web-plates are also made in three lengths, each with their joints opposite and spliced by pairs of 7x $\frac{3}{4}$ and 4 $\frac{3}{4}$ x $\frac{3}{4}$ -in. cover-plates 36 in. long. The bottom flange has a maximum cross-section composed of two 8x4 $\frac{1}{2}$ x $\frac{3}{4}$ -in. angles and five 16 $\frac{1}{2}$ -in. cover-plates aggregating 37/16 in. in thickness. The angles are made in three lengths with their joints opposite those of the top flange and spliced with a pair of 7x3 $\frac{1}{2}$ x $\frac{5}{8}$ -in. cover-angles 39 in. long. The first and second cover-plates

The flange cover-plates are shop-riveted together complete, by a single row of widely pitched $\frac{7}{8}$ -in. rivets through each edge clear of the flange angles, and all other rivets in them are 1-in. in diameter and are field-driven, so as to allow them to be shipped separate from the girder sections. In the center of the girder the vertical rivets through the flange cover-plates and angles have a maximum grip of 7 $\frac{1}{2}$ in. After the three sections of each girder were field-spliced, the top and bottom flange cover-plates, previously shop-reamed to fit, were assembled to them and field-riveted, thus involving a great number of long and large field-driven rivets. The depth of the girders was so great that web-plates could not be made to run horizontally as usual, and therefore they run vertically, and are spliced at alternate web-stiffener angles, the 1-in. plates being 84 and the $\frac{5}{8}$ -in. plates 106 in. wide.

One of the girders in the approach to the double-track Rankin bridge over the Mononga-

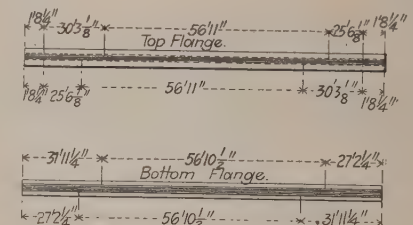
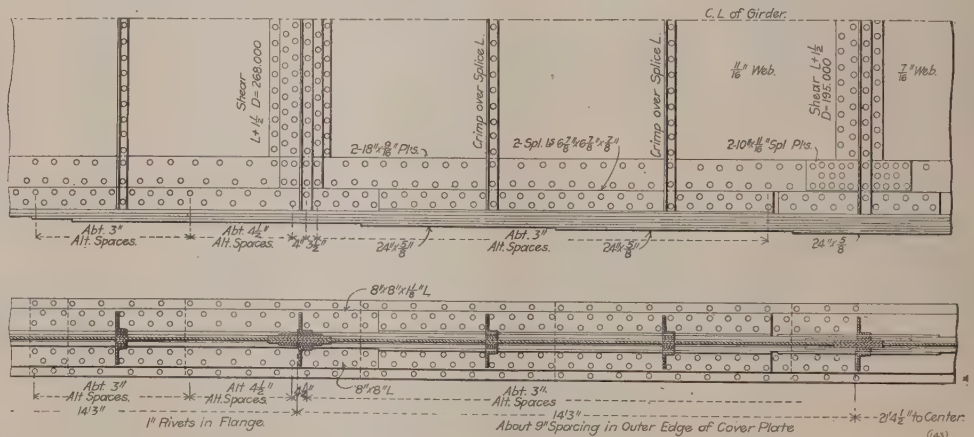


Diagram showing position of Flange L-Splices. (16)



BRIDGE 454, WEST SHORE DIVISION, NEW YORK CENTRAL LINES.

Details of Web and Flange Splices.

are each made in two pieces with their joints spliced by the overlapping ends of the outer center cover-plate. The web-plates are spliced with pairs of cover plates extending only between the flanges, the portion of the web included in the flanges not being spliced.

The center girder of the four-track, 110-ft. 85/16-in., through Clyde River bridge of the New York Central & Hudson River R. R. is one of the heaviest ever built and has an extreme depth of about 12 ft. 2 in. over all. The web-plates are 134 in. high and 1 in., $\frac{5}{8}$ and $\frac{3}{8}$ in. in thickness, spliced with two cover-plates, which in the end panels are 20 in. wide, $\frac{5}{8}$ in. thick, and have 66 rivets on each side. In the center, where the shear is a minimum, they are reduced to 14x $\frac{3}{8}$ in., with 44 rivets on each side. The two field-riveted splices have 20x $\frac{1}{2}$ -in. plates with 66 rivets on each side. The top and bottom flanges were each made with two 8x8x1-in. angles, two 6x6x1-in. angles, four 12 $\frac{1}{2}$ x $\frac{1}{2}$ -in. web-flange cover-plates, and eleven 24-in. cover-plates with a combined thickness of 6 $\frac{1}{2}$ in. The flange-angle joints are staggered and overlap the web joints and are spliced with 6x6x $\frac{3}{4}$ -in. and 8x8x $\frac{3}{4}$ -in. angles 9 ft. long.

hela River is 116 $\frac{1}{2}$ ft. long over all, with a 107 $\frac{3}{4}$ x9/16-in. web made in 15-ft. sections spliced with three sets of double cover-plates giving long top and bottom lines of rivets. Each chord has a maximum cross-section of two 8x8x7/16-in. angles, two 16x $\frac{3}{8}$ -in. side-plates, and five 24x $\frac{7}{8}$ -in. flange cover-plates. Each side-plate and angle is made in two pieces with the shop-riveted joints arranged so that no two are close together, and all are spliced with short cover-plates and angles.

(To be continued.)

THE GENERATING PLANT at Neasden, London, of the Metropolitan Railway Co., is 318x100 ft. in area, and the building is designed to contain four 3,500-kw. three-phase turbo-generators. Steam is generated in Babcock & Wilcox boilers equipped with Roney stokers, and the steam turbines are to be operated condensing with barometric ejector condensers, the cold circulating water being forced to the top of the condensers by centrifugal pumps. The condensed steam and circulating water are then delivered to cooling towers, from which it passes into a cooling reservoir with a large exposed surface.

The New Steel Ferry-House of the Central R. R. of New Jersey.

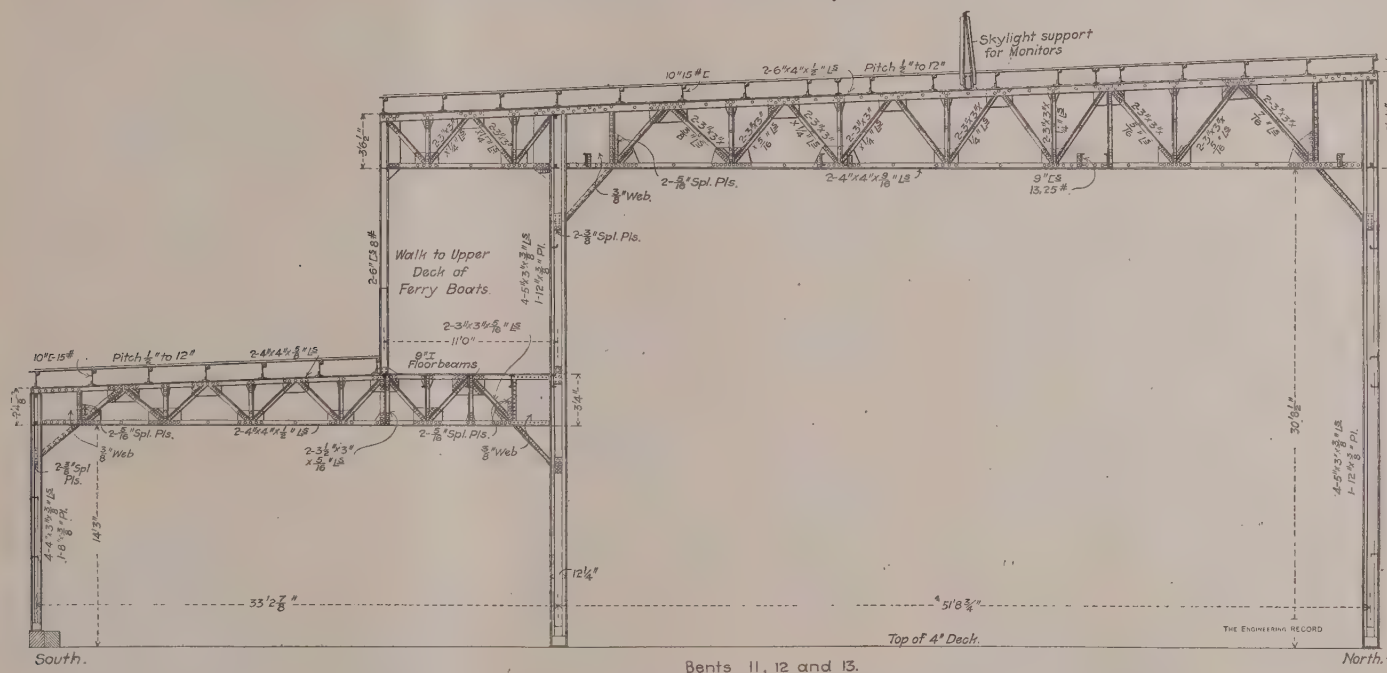
The ferry-house now under construction for the passenger service of the Central Railroad of New Jersey is located alongside Pier No. 62, North River, at the west end of 22d St., New York. It is adjacent to the ferry-house of the Delaware, Lackawanna & Western R. R., next beyond which there are the ferry-houses of the Erie and Pennsylvania railroads. All of them front on an open space or plaza between 22d and 23d Sts., and have been designed so that the architectural features of their entrances shall harmonize. The site occupied by the Central's ferry-house is substantially a long and narrow rectangle, with its axis making an acute angle with the street line. In order to provide a satisfactory entrance it was, therefore, necessary to virtually bend the shore end of the house to a horizontal angle of nearly 90 deg. with its main axis, thus bringing the front of the building and the street shelter parallel to the building line, as indicated by the general diagram.

For convenience, the designs for the ferry-

wedges or hydraulic jacks inserted between the double tier of transverse caps provided for that purpose in the substructure. The pile bents have continuous 12x12-in. caps drift-bolted to the tops of the piles. On them is seated a parallel line of similar timbers separated from them by 3-in. shims and connected to them by vertical through bolts with nuts and washers at both ends which project 12 in. above the tops of the upper beams. The upper beams carry the longitudinal floorbeams and are free to be raised as necessary when the upper nuts are slackened on the connecting bolts. The pile bents are spaced 10 ft. apart, and in the middle and shore-end sections have clumps of piles at the north end and near the center to carry the main columns of the structure on alternate rows.

The columns on the south side of the ferry-house have much lighter loads than the others in the middle section and are carried by two piles at the end of the row. In the sea and shore-end sections some of these columns carry as heavy loads as those on the north side and are supported on corresponding end clusters of piles. At the sea end of the building the ferry-house is built over the slip and the substructure

and consideration of total expense governed the general structural features, and the design of the steel framework was required to correspond with them. This necessitated a number of peculiarities in the outlines of the transverse bents, particularly in the middle section, where it was required to carry the second-story passage to the upper deck of the ferry-boat on the side of the building and to have the floor space beneath it unobstructed, a condition which resulted in the continuation of the trusses of the shed roof underneath the ends of the main roof trusses. The second floor was provided only in such parts of the building as the requirements demanded, and was supported by short-span girders and columns wherever the latter were allowable. In other places long suspended girders were necessitated to avoid floor obstructions. In order to provide the maximum stiffness in the framework at the river end, where the substructure could not be transversely braced, the columns in bent No. 1 were made double. On the south side, where there was an available width of 9 ft., the columns were trussed together and the same design would have been followed on the north



Cross-Section Elevation of Longitudinal Bracing, Ferry House, Central Railroad of New Jersey.

house have been divided into four successive portions designated as sea end, middle, shore end, and shed sections, each of which differs materially from the others in the general design of the superstructure. The entire building, except the shed section, is built on a solid deck of transverse 4-in. planks laid on timber beams and girders supported by about 1,200 piles arranged in clusters and in transverse rows having from 16 to 26 piles in the widest part of the building. The piles are from 16 to 20 in. in diameter and their lengths average from 70 ft. at the shore end to 90 ft. at the sea end. They are driven in water of a maximum depth of 35 ft. at low tide and have a maximum penetration of about 40 ft. in the soft, muddy bottom. They are designed for a maximum load of 8 tons each, and all are theoretically loaded uniformly to the full amount.

At the shore end the city bulkhead of pile, concrete block and rip-rap construction has just been completed and is expected to sink perhaps as much as 2 ft. in the next few years. This will tend to displace the shore end of the pier and provision has been made to maintain it at a constant level by means of lifting it with

ture consists of two side platforms with a space between them to receive the boats. At the end of this slip there is a special independent or isolated construction of vertical and inclined piles driven as close as possible and strongly framed together to resist the shock from the boats without transmitting it to the rest of the substructure. The sides of the slip are extended to a considerable distance beyond the sea end of the ferry-house and are composed of triple and quadruple rows of piles driven as close together as possible and sheeted, with end clusters in the manner usually adopted for such work.

The steel superstructure is a building about 86 ft. wide, with an extreme length of 441 ft., exclusive of the shed section, which is about 45 ft. wide and 100 ft. long. The sea-end section is about 171 ft. long, 45 ft. high at the ridge, and 43 ft. high at the sides. It is made with eight longitudinal panels from 17 ft. to 22 ft. 10 in. long, and one special panel 6 ft. 2 in. long. In each panel there is a transverse bent with two main side columns and a roof truss with full-width span.

The architectural features, the interior ar-

side, but was impossible because the available width of only 5 ft. was not sufficient and the columns were, therefore, connected by a solid web in order to secure the maximum lateral resistance. Bents 2 and 3 are spaced close together in order to form a short panel for the bridge mechanism. The irregularities in the shore section are obviously due to the angle between the axis of the building and its front.

Most of the building is two stories in height, with the second floor carried by the wall and intermediate columns, except in some cases where portions of it are suspended from the roof trusses, as indicated in the diagrams. At the sea end the outside bent is made special with double columns at each end to give transverse rigidity, and has a curved member suspended from the lower chord to provide an arch-shape opening over the boat landing. The second and third bents have special trusses close together, with their bottom chords designed to carry the lift-bridges and operating machinery, and the top chords connected by special X-bracing. All of the other bents resemble bents 2 and 3, except in the arrangement of the second-floor girders and their supports.

by irregular-shape web-plates riveted between the flanges of the lower chord angles and providing for web-connections with the purlins of the middle section, as indicated in the part elevation.

The middle section of the ferry-house has three main longitudinal rows of columns, dividing it into two principal aisles, except at the shore end where the construction is irregular. Both aisles have separate roof trusses knee-braced to the column, the one for the main aisle being much higher than the one for the side aisle and overlapping it about 11 ft. in bents 11 to 16, inclusive, to provide for a second-story passageway to the upper decks of the boats.

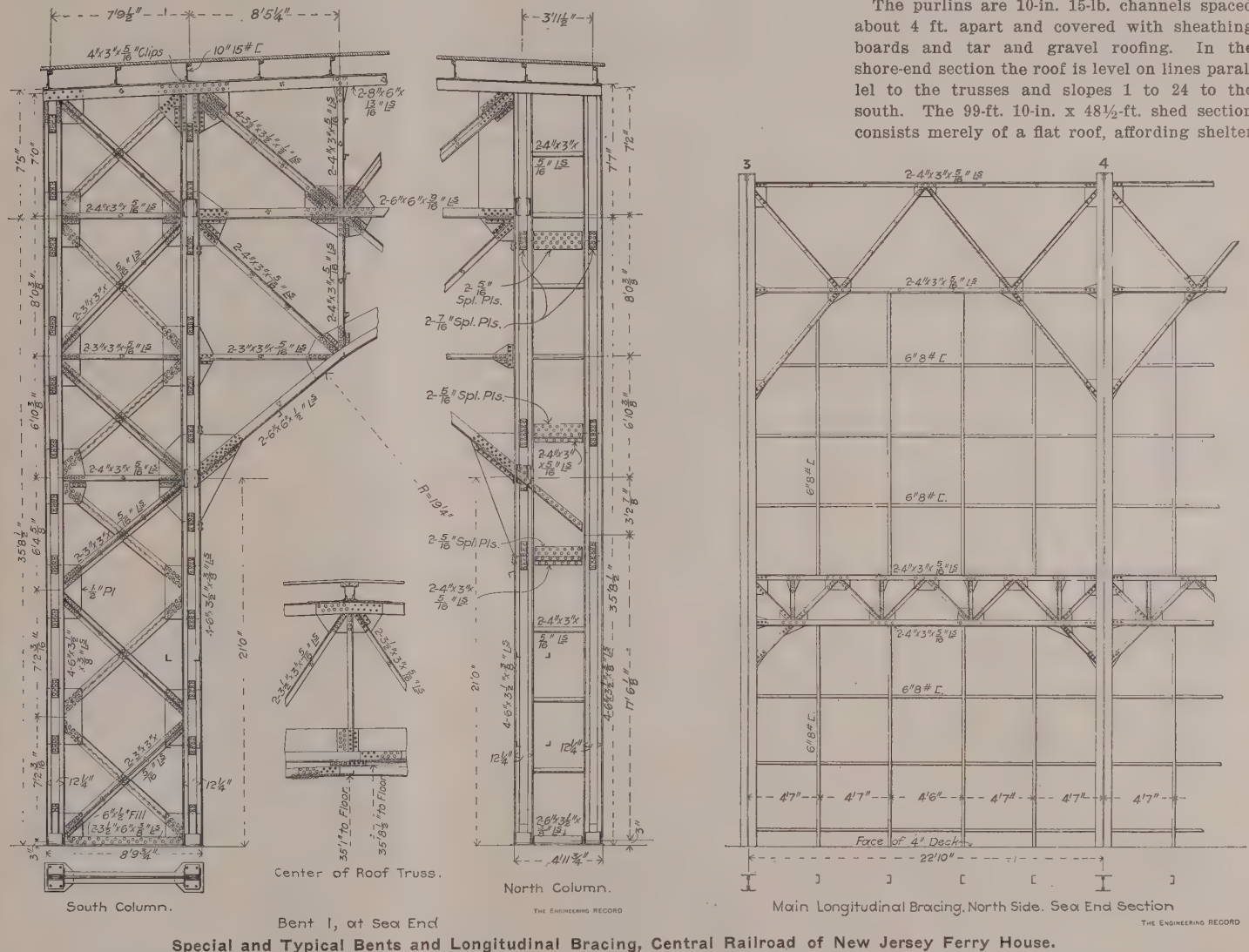
Bents 12 and 13 are duplicates of bent 11, and bents 14, 15 and 16 differ from it chiefly in

lattice-girder 5 ft. 8 in. deep, which is supported at the opposite end by the north column in bent 17, and carries at the center the north end of the roof truss in bent 18, for which it was impossible to locate piles to provide foundation for the direct column support. Care was taken to design the roof trusses of the main and side aisle so as to be uniform and so that the same construction was duplicated between the intermediate columns where the bents have different arrangements, thus materially simplifying the structural work. The roof trusses in bents 11, 12 and 13 are duplicates of the others in this section and are surmounted by a skylight corresponding to that over bents 4, 5 and 6.

In the shore-end section of the building, roof trusses 20, 21, 22 and 23 are supported at their

main columns by light lattice-girders 7 ft. deep, which connect the column tops and are knee-braced to them. An additional line of similar lattice-girder bracing is provided at about the center of the columns on the north side of the building, as shown in a panel of the bracing between bents 3 and 10, where the 6-in. channels for wall studs and girts are also shown. Lateral bracing is provided, as indicated by the general diagram, and consists of 1-in. round upset diagonal rods with clevises and 1½-in. connection pins and sleeve-nut adjustments. They are supported from the purlins near their center points. Longitudinal expansion and contraction is provided for by making bolted connections through slotted holes at one end of all longitudinal members in the panels where lateral bracing is omitted.

The purlins are 10-in. 15-lb. channels spaced about 4 ft. apart and covered with sheathing boards and tar and gravel roofing. In the shore-end section the roof is level on lines parallel to the trusses and slopes 1 to 24 to the south. The 99-ft. 10-in. x 48½-ft. shed section consists merely of a flat roof, affording shelter



Special and Typical Bents and Longitudinal Bracing, Central Railroad of New Jersey Ferry House.

that there is an intermediate column about 16½ ft. from the middle column, which supports one end of the transverse girder extending to the roof truss of the side aisle and flush with its top chord. These girders carry a second-story floor, which is extended across the full width of the building at bent 17, where the diagram shows it carried by transverse girders supported by intermediate columns.

The roof truss in bent 19 is supported on a column at the south end, by two intermediate columns, and by a web connection at the north end to the front truss of the shore section of the building 2 ft. on centers from the supporting column at the west end of the latter. This column is also provided with special double-web brackets forming top and bottom oblique connections for the east end of a longitudinal

north ends by the front bent which is a heavy framework with four columns connected by roof trusses about 12 ft. deep and by the second floor girders and horizontal wall framing members. The columns are spaced to divide the front into a 62-ft. 2¼-in. center panel and two 17-ft. 9¾-in. side panels. In the center panel the lower chord of the roof truss is kneebraced by a continuous pair of curved angles similar to those in bent 1. The spandrels over these angles are braced with vertical and diagonal angles and the space below them is divided into five nearly equal spaces by secondary columns that support the 40-in. floor girder at a height of about 16 ft. in the clear above the ground, and are continued above it to form wall studs.

The bents in the sea-end and middle sections are braced longitudinally in the lines of the

over the entrance to the ferry house. The roof is carried by four cantilever transverse plate-girders supported at the anchor end by connections to girders in the front wall of the building and fulcrumed on cast-iron columns, beyond which they project 10 ft. Both sections of these girders slope slightly toward the columns so that a gutter is formed there which prevents drip from the outer edge of the roof. A longitudinal fascia girder connects the main girders in the line of the columns and parallel with it there are several lines of 12-in. and 15-in. I-beam purlins supporting the roof sheathing. Between the columns and the face of the building there are large skylights.

The building is proportioned for a live load of 250 lb. per square foot of the second-story floor in part of the shore-end section and for

150 lb. in the remainder. The first floor has a capacity of 500 lb. per square foot and a wind pressure of 30 lb. per square foot is assumed on all exposed vertical surfaces. The roof load is taken at 50 lb. live load per square foot. Bents 8 and 9 are proportioned so that, under dead load only, the suspended part of the second-floor girder is cambered $\frac{1}{2}$ in. Under full dead and live load it is deflected $\frac{1}{2}$ in. below the horizontal, and under full dead load and half live load it is level. All steel work has one shop coat of raw linseed oil and two field coats of Atlantic white lead ground in pure linseed oil.

The ferry house was designed and is being built under the direction of the engineering de-

The Somerset Railway Extension.

This road, projected to run from Bingham, Me., to Birch Point, opposite the Kineo House, on the shore of Moosehead Lake, has been located and built to Austin Deadwater during the present season. From Bingham to Austin Deadwater there is a rise of 660 ft. in a distance of 8 miles up the Austin stream. This was surmounted by a uniform grade of 1.68 per cent., compensated for curvature at the rate of 0.03 per degree. This is probably the longest continuous grade in the state. The sharpest curve is 8 deg. Curves over 3 deg. are provided with easements.

The line lays on a very steep-sided hill, the

trestles the following season. This is one of the few localities in the United States at the present time where temporary wooden trestles can be used economically. The fills were made 12 ft. wide, and widened out immediately by gravel train.

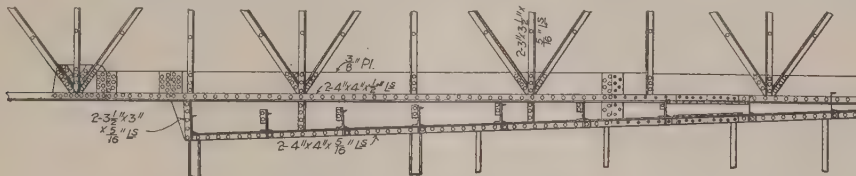
The legs of the steel viaduct above referred to rest on 22 concrete piers. As there was no sand or gravel in the vicinity, it was necessary to haul all the materials for concrete from Bingham, a distance of about $6\frac{1}{2}$ miles. This concrete cost, in place, \$11.21 per yard. The ends of viaduct rest on temporary wooden bents of round lumber, there being no stone suitable for abutments near by.

All box culverts, 58 in number, are made of logs, flattened on two sides. Large openings are crossed by short trestle bridges, also of round lumber.

The cost of the road to subgrade, exclusive of steel viaduct, was about \$9,300 per mile, which is very cheap, considering the country it runs through.

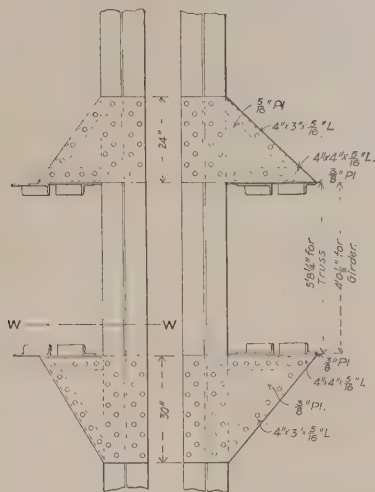
The steel viaduct was built by the Boston Bridge Works. The grading was done by Mitchell & Johnson, of Oakland, Me., and all wooden trestles, timber culverts, widening-out fills, track laying and ballasting, by the company.

This road opens up one of the finest timber sections in the state, and when completed to



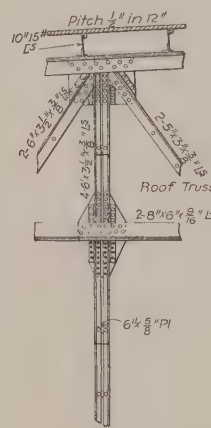
Connection for Low Roof at Lower Chord of Bent 10.

THE ENGINEERING RECORD.



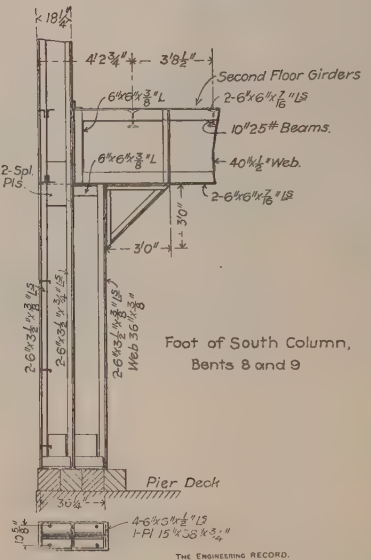
Part of Special Lower Chord, supporting Machinery in Trusses 2 and 3.

THE ENGINEERING RECORD.



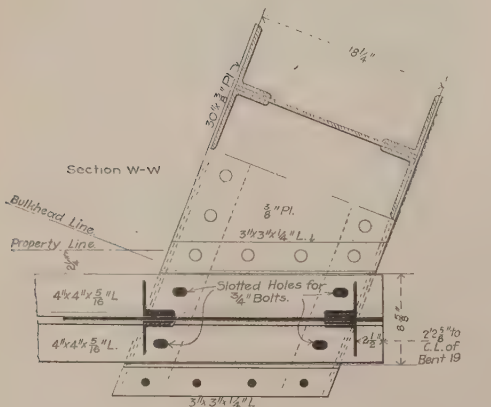
Base of Column A.

THE ENGINEERING RECORD.



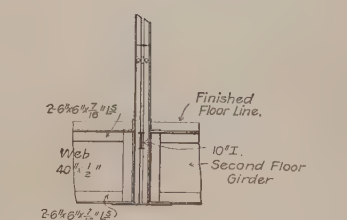
Foot of South Column, Bents 8 and 9.

THE ENGINEERING RECORD.



Detail showing connection of Longitudinal Truss and Girder to North Column of Bent 19.

THE ENGINEERING RECORD.



Suspension of Long Transverse Girder in Bents 8 and 9.

THE ENGINEERING RECORD.

Special Details of Trusses and Columns, Central Railroad Ferry House.

partment of the Central Railroad of New Jersey, Mr. Joseph O. Osgood, chief engineer; Mr. Albert H. Dakin, Jr., assistant engineer in charge of the New York Water-Front Improvements, and Mr. Austin Lord Bowman, bridge engineer. The structural steel work weighs about 750 tons, and was fabricated at the Trenton and Edgemoor shops of the American Bridge Co.

ELECTRIC HEATING OF HOUSES at Davos, Switzerland, is based on 253 watt-hours per day for 12 cu. ft. of space, according to an article in the "American Electrician." This amount is too great in a mild winter.

slopes varying from $3\frac{1}{2}$ to 1 to 1 to 1. Considerable difficulty was found in fitting the line to the ground. In one place it was necessary to blast out a shelf, for the roadbed, through the solid rock, for a distance of nearly 1,300 ft. Five deep gulches are crossed, one (at the Gulf Stream) by a steel viaduct 500 ft. long and 118 ft. high, and the others, ranging in height from 38 to 52 ft., by temporary wooden trestles of round lumber, cut on the spot. About 242,000 ft., board measure, of lumber was used in these trestles, costing \$9.42 per 1,000, erected, divided as follows: \$3.50 for stumpage, \$2.50 for hauling and cutting, and \$3.92 for framing and erecting. It is intended to fill these wooden

Moosehead Lake, will shorten the distance for tourist travel between Boston and the Kineo House about 70 miles. Eighteen miles are now under contract in addition to eight built this season, and the remainder of the line is now being located. Mr. W. M. Ayer, Oakland, Me., is general manager, and Mr. Henry F. Hill, Augusta, Me., is chief engineer of the road.

THREE CENTRIFUGAL PUMPS, each with a cast-iron impeller 7.5 ft. in diameter, a 60-in. discharge pipe, and a capacity of 120,000 gal. per minute against a head of 12 ft., have been installed by Messrs. W. H. Allen, Son & Co., Ltd., of Bedford, Eng., at the Cardiff railway docks.

The Extension of the New York Rapid Transit Lines.

The last week of 1904 was marked by the appearance of one of the most important engineering reports of the year. It was submitted to the New York Rapid Transit Railroad Commission by Mr. Wm. Barclay Parsons, chief engineer, and outlined general plans of additional rapid transit lines in Manhattan, Brooklyn, and the Bronx. The plans provide three classes of new lines, those open to competitive bidding, those that will be extensions of the present subways, and those that will be extensions of the present elevated railways. The accompanying map shows the present and proposed lines of the Commission in Manhattan and the Bronx only.

The two companies now operating the transportation lines in the boroughs of Manhattan and the Bronx have already publicly signified their intention of bidding upon any new contracts that the Commission might offer, and to this end these companies submitted some time ago tentative plans of their own. These tentative plans were subsequently considered by Mr. Parsons, and after consultation with the engineers of both the companies, were so modified that one general plan could be prepared comprising the essential features of both plans. The plans presented last week contain the salient features of that project, modified in certain details as after further study seemed more desirable, and as the experience with the existing subway would seem to indicate as wise.

Competitive Lines.—The general theory of Mr. Parsons' plan provides for a through line from the borough of the Bronx on the east side of the city to the Battery, and on the west side from the Battery to 42d St. This would be an operative railroad in itself. By making a cross connection at 34th St., and by making connections with the subway at Battery Park, at 42 St. and Park Ave., and in the neighborhood of 42d St. and Broadway, the Interborough Rapid Transit Co., if awarded the contract, could, by building the lines north from 42d St. on the east side, and south from 42d St. on the west side, make, with the present subway, complete east and west side railways extending from the Battery to points beyond the Harlem River, and with a connection passing beneath the East River to the borough of Brooklyn. Or should the New York City Railway Co. be awarded the contract it could, by omitting the connecting link from Park Ave to Lexington Ave., and from 34th to 42d Sts. on Seventh Ave., and instead, by building the line under 34th St. connecting the east and west side lines, be able to offer to the city a through line from the Harlem River to the Battery on the east side, and on the west side as far north as 34th St., which could be extended northerly.

On the east side line, on account of the narrowness of the streets and other local conditions, it would be possible to construct but two tracks from South Ferry to 34th St. and Lexington Ave., but from that point north and on the connecting line between Park Ave. and Lexington Ave., and under Lexington Ave. to and across the Harlem River to the terminal loop at 142d St., it would be desirable to construct four tracks, placing them in tiers, the local tracks above and the express tracks below. On the west side line there should be four tracks extending south from 42d St. to some point below Chambers St., depending upon the available width of the streets, and thence with two tracks, to connect with the east side line or the subway at the Battery. This arrangement of tracks has been worked out by making a loop beginning at Murray St., passing under private property at Murray, Greenwich and Barclay

Sts., and returning thence to the four-track system. This loop could be so arranged that the local trains could turn at this point and the express trains be run to Battery Park, making all stops below Barclay St. in the same way as it is proposed to run trains south from the Post-office along Broadway on the present system.

The crosstown connection under 34th St. should be so arranged, in the event of the west side line terminating at 34th St., to provide a northerly outlet for such line connecting with the lower tier of tracks under Lexington Ave., and so avoiding any grade crossings at the junction. The line on Park Ave. has already been arranged in the present construction to provide a suitable junction between the existing line and the east side line. North of 42d St. and Broadway the present subway will have to be partially reconstructed to permit suitable reconstruction to be made. This, however, is possible.

In the laying out of traffic routes it is obviously desirable, so far as possible, to avoid conflicting with existing lines; in this way the public will receive the best service by getting a multiplicity of routes rather than a duplication of facilities on the same routes. The present plans accomplish this result, except on the line south of Third St. on the west side, where a duplication of routes seems to be unavoidable, provided the new route is to be kept as near Broadway as possible in order to meet the traffic demands. East of West Broadway the streets are too narrow to be used for railway purposes.

The west side line as laid out would connect with the new station of the Pennsylvania R. R. facing on 7th Ave. Should the Interborough Rapid Transit Co. be awarded the contract, and not be a bidder for the line under 34th St., this latter route could then be made use of by the company proposing a moving platform, which could become a bidder for this portion of the general plan.

In order to provide for a division of these plans, so as to accommodate various bidders, the whole scheme has been divided into the following sections with the approximate lengths:

Section A-B, from Battery Park to Lexington Ave., at 44th St., 23,600 ft.

Section B-C, from Lexington Ave. and 44th St. to Morris Ave., including the terminal loop, 29,850 ft.

Section C-D, from Morris Ave. to connect with the subway at East 149th St., 2,000 ft.

Section A-E, from Battery Park to 34th St. and 7th Ave., 20,850 ft.



Rapid Transit Lines in New York.

Section E-F, from 34th St. and 7th Ave. to connect with the present subway between 42d and 46th Sts., 3,300 ft.

Section E-G, from 34th St. and Broadway to 34th St. and Lexington Ave., 3,600 ft.

Section H-B, from a connection with the present subway under Park Ave. south of 42d St. to Lexington Ave. at 44th St., 2,000 ft.

The total length of all the above lines is 16.15 miles.

The Board directed Mr. Parsons to lay out a line in Brooklyn extending from Fort Hamilton under 4th Ave., to Flatbush Ave., and thence under Flatbush Ave. to and across the Manhattan Bridge to Manhattan. This route will be an expensive one to build and is paralleled its whole length by an elevated railway, either on the adjacent street or immediately above it, and on reaching Manhattan will not be able to provide through facilities except by transfer. Should it be decided to build a subway line under 4th Ave. to Fort Hamilton, Mr. Parsons suggests an alternative, by diverting from 4th Ave. to Hamilton Ave., thence under Buttermilk Channel to Governor's Island, and under the East River to Battery Park, and thence, if desired, by tunnel under Greenwich St. to connect with the low-level loop at Barclay St. This would provide a direct through communication with South Brooklyn.

Present Subway Extensions.—The line in Brooklyn is the one for which the junction has already been provided at the Prospect Park Plaza, and extending thence easterly under the Eastern Parkway. This is a section of Brooklyn to which the attention of the Board has already been directed and is without direct transit facilities.

The lines in the Bronx are first, an extension of the present system from Kingsbridge northerly along Broadway to Van Cortlandt Park. Efforts have been made by the Interborough Rapid Transit Co. to arrange terms with the New York Central R. R. to use the Putnam Division of that company northerly to Kingsbridge, but without satisfactory results. It is desirable that the west side system should go to Van Cortlandt Park, and Mr. Parsons suggests an extension of the subway system from Kingsbridge to the Park, but at this point necessarily by elevated structure.

The second line in the Bronx is one extending the present subway system from its terminus at 180th St. and the Boston Road. This portion of the present system is an elevated structure, and immediately north lies Bronx Park, and that portion of Bronx Park nearest to it having been set aside for the Zoological Gardens. North of Bronx Park lies a section extending to Mount Vernon not now reached by any rapid transit lines. It is possible to extend the present elevated structure over Boston Road to Bronx Park, and then to take advantage of the topography of the ground to grade the surface of Bronx Park at its southerly end so as to avoid any elevated structure in Bronx Park, and by building the railway on a descending gradient to pass beneath the roadway leading from the principal entrance on the Boston Road, and thence beneath the surface of the Park to its northerly limits at the Bronx River. The river will be crossed on an ornamental bridge, and thence the railway will again be taken underground beneath the Pelham Parkway, and by making use of private property and a suitable incline to pass from the subway to elevated lines, and so over the White Plains Road to the City Line.

The district north of the Bronx needs facilities, which can be furnished only by a line such as has been described, or by a more circuitous route to the east of Bronx Park. East-erly of the present system no route has been

suggested in the Borough of the Bronx. Plans are now under way by the New York, New Haven & Hartford R. R. Co. for adding four additional tracks to their present system, and plans are also under way by private companies looking to the building of new lines in this portion of the city.

The length of lines suggested by extending the subway system is as follows: Eastern Parkway, 6 miles; Van Cortlandt Park, 1.1 miles; Mount Vernon, 4.8 miles; total, 11.9 miles.

Elevated Railway Extensions.—Nearly two years ago Mr. Parsons reported strongly in favor of extensions of the present elevated railways, and last week he reiterated these recommendations. He recommended particularly an extension of the 8th Ave. division of the Manhattan Ry. across the Harlem River, thence by tunnel beneath the ridge under 161st St. to Jerome Ave., and thence by elevated line over Jerome Ave. to Woodlawn. The Jerome Ave. line is one which has been discussed before the Board on many occasions, and the advocates of subway and elevated construction have both been heard. The principal property owners who have in the past opposed elevated railway construction have recently informed Mr. Parsons that they have been converted to the other view and believe it would be best for that portion of the city to avail itself of an elevated line as rapidly as possible, and to this end they preferred the extension of the Manhattan system.

Attention was also called to one other extension, the reconstruction of the 2d Ave. division of the Manhattan Elevated Ry. The lesson to be learned by the present subway is the great advantage of an express service, and especially an express service that runs continuously in both directions. Mr. Parsons advised some time ago the reconstruction of the 2d Ave. line by building it with four tracks, carrying the two additional tracks over the present elevated system at Chatham Square to City Hall. This recommendation is repeated. The borough of the Bronx, especially that portion of it contiguous to the suburban division of the Manhattan system and the Westchester Ave. line of the subway system, has lately increased tremendously in population. This increase will, with the proposed facilities to be furnished by the New York, New Haven & Hartford R. R. and other companies in the easterly portion of the Bronx, demand additional facilities. Such facilities can be afforded by converting the 2d Ave. line into a four-track system. The 2d Ave. line is sufficiently strong to carry four tracks, so that the superstructure alone would have to be remodeled.

Crosstown lines should be worked independently of the existing north and south lines, transferring to them. At present it would seem as if the surface lines could readily accommodate this transfer business. Subsurface crosstown lines, however, can be laid out at any time, as each one would be an independent structure.

In regard to the expense involved it is impossible to make a close estimate until further details have been decided upon by the Board. For the 4th Ave. line in Brooklyn, Mr. Parsons can make no estimate until the Board decides whether the line should proceed via the Manhattan Bridge or via the Brooklyn tunnel. The new lines in Manhattan will cost about \$40,000,000. The extensions to the subway system, including the Eastern Parkway and the two lines in the Bronx, will cost about \$9,000,000.

A POWER CANAL, over 37,283 ft. long, partly ditch and over 4 miles wooden flume, serves the plant of the American River Electric Co., near Placerville, Cal.

The Appraisal of Water-Works in Maine.

The Supreme Court of Maine recently laid down the following rules for the determination of the value of water-works belonging to the Maine Water Co., in an action brought against it by the Brunswick and Topsham water district:

1. Franchise values are not to be disregarded, the element of going concern value is not to be considered only as involved in structure value, and property value in this connection is not merely structure value.

2. That the structure taken is in use, and that it may lawfully be used where it may properly enhance its value.

3. The direction of the statute to fix the valuation of the plant and franchises is in substance a direction to fix the valuation of the plant as affected by the franchises.

4. Prior cost is not the only criterion of present value. The rise and fall of cost of material is to be considered.

5. In determining what are reasonable rates, the amount of money which has been actually and wisely expended in producing the plant is a primary consideration.

6. The question of the reasonableness of rates relates to both the owner and the customer. But in case of conflict, they must be reasonable to the customer in any event.

7. A public service company cannot lawfully charge more than the services are reasonably worth to the public as individuals, even if charges so limited would fail to produce a fair return to the owner upon his investment.

8. Profits which exceed a fair return on the owner's property furnish no criterion of either franchise or going concern values.

9. All issues are to be determined by a preponderance of the evidence.

10. The value is to be fixed as of January 1, 1904, and market prices of materials and labor on that day or during a period long enough before that time for construction, are the standards, rather than former prices. Interest upon the money invested in the plant during construction is a part of the cost of construction.

11. Damages for severance are to be allowed.

12. The rules of damage prescribed by the legislature are to be deemed effective, because by the approval of the charter they were assented to by the inhabitants of the water district.

13. In estimating the value of a public service, one of the elements necessary to be considered is the expense at which the public or customers, as a community, might serve themselves, were they free to do so.

15. If there is more than one source of supply, other things being equal, the community is entitled to have the least expensive one used, and the supplying company is not entitled to charge an enhanced rate based upon the cost of using a more expensive source.

16. When the rates which furnish a basis for estimating value are earned in part by property taken and in part by property not taken, the appraisers should charge the property taken for only its fair proportion of the earnings.

17. While the award of the appraisers must be made under the principles of eminent domain, it must be made upon such principles of eminent domain as were agreed to by the voting constituents of the water district, by approving the charter.

ELECTRICITY FOR TOWN HEATING, as well as for general cooking, lighting and power, has been adopted for Davos, Switzerland, according to Mr. Geo. E. Walsh, in the "American Electrician," to prevent air contamination by smoke.

Methods of Location on the Choctaw, Oklahoma & Gulf R. R.

Few features of American methods of conducting civil engineering work have attracted more attention from engineers of other countries of late than the practice followed in locating railways. Among the engineers whose recent work has been particularly noticable in this line is Mr. F. A. Molitor, chief engineer of the Choctaw, Oklahoma & Gulf R. R., which built between 1898 and 1902 some 800 miles of branches and extensions, and at times kept ten or more locating parties in the field simultaneously.

The paper by Mr. F. Lavis on this subject, which was presented before the American Society of Civil Engineers on Jan. 4 (Proceedings, Am. Soc. C. E., vol. xxx., p. 864, "Methods of Location on the C., O. & G. R. R."), may therefore be taken as descriptive of the system best adapted for country like that of Oklahoma, Indian Territory and Northern Texas. The particular section in which Mr. Lavis was engaged was a rather badly broken up, rolling country, with short cross-drainage, about three-quarters being wooded, and, in Indian Territory, very sparsely peopled.

On a proposed line of about 300 miles in length, a general route was established from previous reconnaissances with certain towns as governing points. The low grades desired, 0.5 and 0.6 per cent., compensated for curvature, and the nature of the country involved considerable study of a rather wide range on either side of the proposed general direction of the line. No Government topographical maps of the country had been issued, and the only maps available were those published by the Public Lands Survey, showing fairly accurately, in relation to the section lines, the general location of the larger streams and rivers and some of the main roads. Five locating parties were placed in the field, each assigned to about 60 miles.

In working out the details of the location, nearly the whole time of the locating engineer was spent looking up the general broad features of the country, the actual work of looking after the field party and running the preliminary line devolving practically entirely on the assistant locating engineer.

In laying out the work for the assistant locating engineer, considerable use was made of rough sketches showing the general topography of the country, and, each evening, with the aid of these and the map profiles of the lines already run, the following day's work was arranged. During the day, the locating engineer found the party at more or less frequent intervals, saw that the line was being run as desired, and made such modifications or revisions of instructions as might be necessary.

A special point was made of actually running a preliminary line, getting the topography on it and making a projected location and profile wherever there was a reasonable possibility of a good line existing. Especially is this important in wooded country, where the difficulties of comparatively small details are apt to be magnified, and a good location missed because of the actual physical difficulties of getting over the ground, or of sizing up the topography as a whole.

On making the final location, the assistant locating engineer obtained from the map the necessary data to connect the located line with the preliminary, and to lay it out on the ground as projected, which data he kept in a notebook used for that purpose only. He had with him in the field a copy of that portion of the projected profile covering the work in hand. The points on the located line were fixed by hori-

zontal distances from the hubs on the preliminary, and also, and especially where the slopes were at all steep, by vertical distances, and points of elevation fixed by the leveler.

It should be noted especially that, in anything like rough country, the essential point, in running in a location from a line projected on a map, is to reproduce the projected profile rather than the projected line. After deciding that the projected profile is the one to be obtained, the location must be passed through all the controlling points whose vertical distance (or, rather, elevation) is such as called for by the projected profile and determined by leveling from some known elevation (a hand-level will generally give close enough results).

In settled cultivated country, on both preliminary and location lines, hubs were set at all fences, as both stakes and hubs in the fields are frequently, and, in fact, usually, pulled up or destroyed soon after the line is run, while the hubs at the fences remain, enabling the ready re-establishment of the line. All tangents were run to an intersection, the P. C. and P. T. of all curves being set before the curves were run in. Surveys were made of, and levels run on, all railroads crossed, for one mile on either side of the line.

Bench-marks were established every mile on preliminary lines and every half-mile on final location, care being taken to have these latter convenient for construction purposes, especially near bridge openings, etc., and away from all danger of being interfered with by the excavation. The elevation of each bench-mark was plainly marked on or near the same.

Topography was taken for 300 ft. on each side of the line, in cross-section books, ruled, on a scale of 8 ft. 1 in., in 100-ft. squares, subdivided into 10-ft. squares.

In the field a hand-level and a light wooden rod, 2 in. by $\frac{3}{4}$ in. by 12 ft., marked every $\frac{1}{2}$ ft., were used, and distances out were paced, or measured with a cloth tape, according to the nature of the ground, and 5-ft. contours were located and sketched in, care being taken at angle points to get sufficient information to connect the contours properly on the map.

The first duty of the field draftsman was the preparation of the general map on the 5,000-ft.-to-1-in. scale, from the best available sources, covering the whole of the country in which the proposed line might lie. This 5,000-ft. map and profile are absolutely essential to a broad, comprehensive study of the line as a whole; it can be readily seen from this whether or not a good general direction is being maintained, and the general relation of the line to the surrounding country is shown. A tracing was made of this map, and, as soon as completed, sent to headquarters; from day to day, the preliminary lines run were plated on it, and, also, the projected location and profile, as they were made.

At the end of each week a tracing of the portion of the map showing the additions made to it during the previous week was sent to headquarters, where the information was transferred to the original tracing. The weekly report which accompanied this map explained in quite full detail such points in connection with it and the work as seemed to require explanation.

All the preliminary lines run during the day were plated on a 400-ft.-to-1-in. map in the evening, from the calculated courses and distances; no platting from deflection angles was allowed.

It was absolutely required that the projected location should fall within the limits of the topography, that is, within 300 ft. of the preliminary line, and if, for any considerable distance, it was more than 200 ft. from the preliminary line, it was often deemed advisable to cover this with another line.

In making the projected location a sheet of tracing cloth, on which was drawn in ink to the scale of the map the curves proposed to be used, with tangents at the ends, was found very useful in fitting the alignment; 100-ft. stations were marked on these curves on the tracing cloth, so that, when laid above the topography sheet, pieces of profile could be readily read off. No P. C. or P. T. was allowed to come within 400 ft. of the end of a bridge; all curves were of even degree of curvature, being either 1, 2, 3 or 4 degrees, and all grades were in even tenths of 1 per cent.

Mr. Lavis objected to the limitations of the degrees of curve at first, believing that a nicer adjustment could be made by using any degree, with indices of odd minutes when necessary, that seemed at first to fit the ground better; but by being compelled to use the even degrees, found afterward that this could be done almost invariably just as well, but required perhaps more study of the situation. Of course, no rules of this kind can be absolutely iron-clad, and the principal assistant engineer at times modified them himself; but it was considered advisable to make them binding as far as the locating engineers were concerned.

The projected location being made and penciled in on the 400-ft. map, the profile was taken off and the grade line fixed, grades being kept in even tenths of 1 per cent., except where compensated for curvature, and even then, if possible. Of course, in long stretches of ruling grade, where often every inch counts, hundredths of 1 per cent. rates occurred where compensation was made. Breaks for compensation were made at the even stations nearest the ends of the curves.

All bridges and culverts were located on this profile, the probable quantity of classified excavation in each cut was indicated, and an estimate made of each mile. The classification of the material in the cuts, as shown on the projected profile, was made by the locating engineer from his observations of the surface indications; of course, this was only approximate.

From time to time the principal assistant engineer visited each locating party in the field, and thus kept in touch with the work and results of each. At the same time, the 5,000-ft. map and profile, etc., kept the record at headquarters complete. All projections adopted for location were examined and approved by the principal assistant engineer, and, after approval, no deviation was permitted without authorization. By this means a detailed study of the line was possible; much more so than when viewed only on the ground by those superior to the locating engineer.

Instructions were given the locating engineers to spend all the time necessary on investigations, to be sure they had the best line through the country traversed before putting in the location, on the ground. Mr. Lavis mentions one stretch of line, about 16 miles in length, where he spent nearly three weeks, running over 80 miles of preliminaries, besides the original preliminary and projected location, before the final line was decided on. A second projected location saved a mile of distance over the first, besides eliminating much curvature and rise and fall, and, but for the very positive instructions received to exhaust every possibility, and the receipt, about this time, of a letter from the principal assistant engineer, who knew the difficult nature of the country, reiterating his caution, this line would have been run in. Other lines were run, the final location effecting a saving of more than \$30,000 in estimated cost of construction, and eliminating many degrees of curvature and more rise and fall.

As the final located line was run in, it was

inked in on the 400-ft. map, radii of curves were drawn, stations of P. C. and P. T. marked, and calculated courses of tangents from observations of Polaris, length of tangents, the degree of curve, central angle, and the length of semi-tangents noted at each curve; drainage areas, as definitely determined by the topographer, were dotted in, and areas noted; as were also property lines and owners' names, thus making the map a complete record.

The Road Investigations of the Department of Agriculture.

The work of the Road Material Laboratory, now the Division of Tests, has been much broadened and its value and importance increased during the past fiscal year, according to the report of Secretary Wilson, of the Department of Agriculture. The routine tests on road materials are carried on as usual, and several of the tests have been improved and standardized. The importance of testing rocks to be used in road building is being recognized at the present time by the leading highway engineers of the country, and a number of laboratories modeled after the Department Road Material Laboratory have been established in different places.

Clays for Road Making.—Of the 228 samples of road materials reported for the past year, 35 were clays. This is mentioned to show the high percentage which clay bears to the whole number of samples received; for it is a fact not generally recognized that in vast areas throughout the country clay is the only material of which roads can be built. For this reason much time has been spent in studying the physical properties of clays in the endeavor to devise methods by which they can be utilized in road making. It may be mentioned here that up to the present time but one method of using clay in road building has been generally known, that is, to mix it in the proper proportion with sand. This method, however, is not always practicable, for in many districts sand is difficult to obtain. Many inquiries had been received as to methods of treating roads in some of the Western and Southwestern states, where, owing to absolute lack of hard materials and to the extremely sticky nature of the country clays, many of the farmers were absolutely cut off from the towns during the wet portions of the year. It was apparent that if the local clays could be cheaply burnt to a hard, dense clinker a good road material could be provided. Preliminary to actual work on a large scale and expensive experiments on the ground, it was necessary to make laboratory tests of the clays to see whether they would burn to a dense, hard clinker. Samples of the well-known so-called gumbo clay were sent to the laboratory from the Yazoo district of Mississippi. These samples were experimentally burned in the laboratory of the Division, and it seemed quite possible to use the clays in the manner as indicated above.

Following upon this experiment, the Office of Public Road Inquiries built an experimental road in Yazoo City, which has been reported successful. It is needless to point out the great importance of the success of such experiments in relation to road building in localities in which no rock is to be had.

Cementing Power of Road Material.—The satisfactory investigation of the important property of binding or cementing of road materials when used upon roads has been continued and much new evidence has been obtained. Under the old rule-of-thumb methods of road building one sort of rock was supposed to be as good as another. Miles and miles of expensive roads have been built in a haphazard way, of any sort

of material that was available, and many of such roads have "raveled" and gone to pieces almost as rapidly as they could be built. Since the establishment of the proper methods of testing and investigating these materials, there has been noticed a great improvement of roads. The most intelligent and progressive of the state highway engineers are availing themselves of the opportunities extended to them by the Department of Agriculture for studying and familiarizing themselves with the physical properties of the materials which they are about to use before risking the public moneys in expensive work.

The hardness and toughness of a rock which is going to be used on a road are, as everyone knows, important properties, but the property which causes this rock under the influence of traffic to bind or cement together so as to form a smooth, even, impervious shell on the surface of a road is even more important. When the work of the Road Material Laboratory first began the importance of this quality had hardly been recognized, and absolutely nothing was known as to the reason why one rock should possess this property to a very high degree and another of perhaps identically the same name and species should be entirely lacking in it. The closest investigation has been given to this subject and to the collection of all possible data and information, not only from the theoretical and laboratory standpoint, but also from a practical point of view. It is safe to say, Secretary Wilson reports, that its satisfactory solution has been accomplished. A bulletin on "The Cementing Value of Road Materials" has just been published, and the publication of more work in the same line will follow shortly.

A new test for determining the toughness of rock and asphalt mixtures for road building was brought out during the past year, and several new tests are at present being developed.

Use of Oil on Roads.—Much interest has been felt in different parts of the country in the use of oil for treating the surfaces of highways, in order to lay the dust and to offer a hard, impervious, waterproof surface. It is well known that in California such treatment of roads has met with a high degree of success. Similar experiments, however, when carried out in the East, proved complete failures; the Eastern soil failed to bind on the surface of the road, and did not lead to the desired result. When it was found that the main difference between the California natural oils and the Eastern and Texas oils lay in the fact that the California oils contained an asphalt base, while the Eastern oils contained a petroleum or vaseline base, the Division of Tests immediately suggested that the cause of the failure of previous Eastern experiments was directly due to this fact, and road builders throughout the country were urged to make experiments with mixtures of crude oils with crude asphaltum.

Last summer the Commissioners of the District of Columbia consented to make such an experiment. A street in Washington was selected for the purpose and a number of mixtures of Southern crude oil and asphaltum were spread in adjacent sections. At first the experiment was looked upon as a failure, but the road has been steadily improving, and at present there is every promise of the experiment proving a success. If it proves true that mixtures of Eastern crude oil and asphaltum make as good roads as the California oils do, a very great advance will be made toward the betterment of our rural highways.

School for Road Building.—One of the chief lines of work for this division during the present year is the establishment of a school of road building. The object of this school is to give a one-year course in highway engineering

and the testing of road materials, to about four young men who have received degrees from reputable engineering schools. These students are to be selected by a civil-service examination. They will devote six months to the study of road-building problems and road materials, and six months to field work, which will consist of actual road construction. Men with such training are sure to be of the greatest service to the country, not only in constructing highways, but in disseminating accurate knowledge on highway construction.

Office of Public Road Inquiries.—Popular interest in road improvement appears to be deeper and more widespread than ever before. This is evidenced by the work of improvement actually going on in nearly all sections, by the state road legislation, by the calls for the road literature issued by the Department, and by requests for the advice and co-operation of the Department in building object-lesson roads.

For greater convenience and efficiency in carrying on the field work of the Office of Public Road Inquiries the country has been somewhat roughly laid off into four main divisions, with a special agent in each. The work of these and other special agents in the field consists in collecting and disseminating useful information regarding roads and road building, conducting investigations and experiments, attending and addressing meetings, and representing the Department in co-operative object-lesson road work.

At several points in the South the Office of Public Road Inquiries has co-operated in the construction of experimental roads of a mixture of sand and clay, and the results have shown that, in the absence of stone and gravel, this mixture may often be used to great advantage. Other object-lesson roads were constructed, with the co-operation of the Office, in Arkansas, Ohio, Tennessee, Virginia, and West Virginia. These were in most cases first-class macadam roads. An especial effort has been made to keep accurate accounts of the work done in each case, and to report the operations and expenses in such details as to make the work a source of instruction to all who may read the reports.

Reports from all sections of the country in which experimental and object-lesson roads have been built in previous years are unanimous in commending the character of the work done and testifying to its great influence for good.

It is intended that the work of the Office shall be continued along the present lines of helpfulness and extended so far as practicable, in order that its benefits may be most widely distributed.

MINOR REPAIRS on the Lowell, Mass., waterworks have been made during the summer for several years by a special gang of men. The men work in couples, each couple being given a certain section or district to cover, and provided with a wheel-barrow containing the necessary tools for their work. They are generally men who have been connected for years with the department, and are more or less skilled and familiar with the location of street mains, services and gates. Mr. Robert J. Thomas, superintendent of the department, states that they do such work as keeping the service, hydrant, and gate boxes in repair, flushing of the mains, laying new services and changing old ones, and any emergency work that arises. Formerly other men were employed to do service main work exclusively, but this gang has been found to be more efficient in that work, and in case they finish a service connection too near quitting time to start on another, they have plenty of regular work to keep them busy.

Formulas for Hips and Valleys.

By O. E. Emrich, Ambridge, Pa.

In the experience of the writer the structural draftsman is called upon very seldom to deal with the subject of hips and valleys, when compared with the general line of work which his office affords. As a consequence, those who have coped with the subject will generally be compelled to freshen up on the question whenever they have such work to detail, resulting in the looking up of information on blue prints which most offices have; the assistance of the other men in the office, and also resorting to printed matter which was probably published in the engineering magazines months back. In any case a large amount of time may be thus absorbed in again gaining the knowledge which has been forgotten, due to the lack of opportunities of dealing with this class of work.

all on one sheet, thus making it adapted for use in the drawing room. The final results are not new, they being the well-known Turner formulas, and therefore arrangement and actual derivation of results, both graphical and trigonometrical, are the points to be considered.

It is assumed in advance that the draftsman is at least acquainted with the rudiments of trigonometric functions of angles and descriptive geometry. One not so acquainted had better not tackle such a problem, for he may spend many unhappy moments before he is through.

In view of the above the following brief explanation will suffice. The distances denoted by a, b, c, d, e, are the properties of the roof and are always known. Distance a is the height of the transept and main building trusses; distance b is half the span of the transept truss; distance c is half the span of the main build-

ing to find is undoubtedly the angle M, which gives the bevel of the bent plate on the purlin, which in turn is fastened to the valley rafter. It is found as follows: Draw the purlin plane, as shown, through the point where the right angle is found in the end view of the transept truss, at a distance X4 from the center line of the valley rafter and perpendicular to the transept truss rafter. With the purlin plane in this position, revolve the valley plane down onto the horizontal plane, and then the distance X4 becomes vertical. Through this line pass a plane normal to the line of intersection of the purlin and valley planes. This gives the distance X6. $\tan M$ is then $X6 \div X4$. Substituting the values for numerator and denominator as given on the left, $\tan M = \tan B \cos X$. M', the corresponding angle on the other side of the valley rafter, is found in a like manner.

It will be noted that the actual figured lengths of the distances X to X16, inclusive, need not be found; merely an expression for them will suffice, since they cancel out in the equations. By carefully following the diagram the other angle values are easily obtained.

All results have been carefully checked, and it is therefore hoped that all errors have been eliminated.

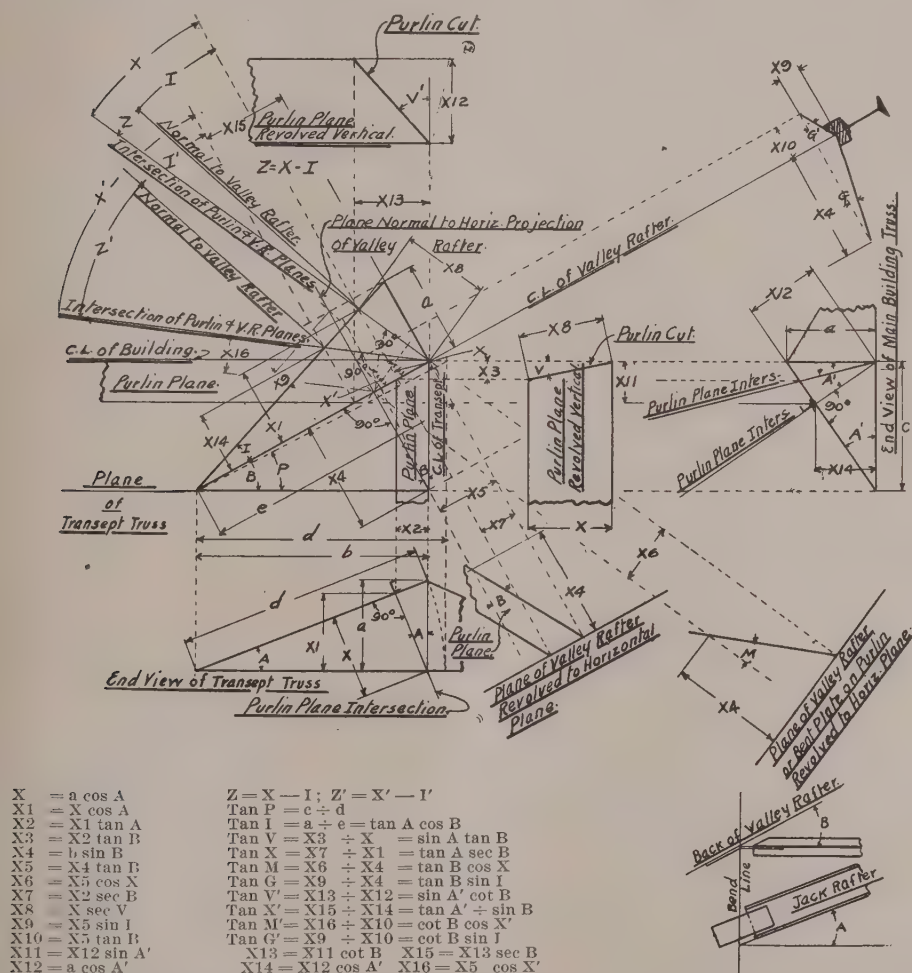
Success in Electrical Engineering.

Extracts from an address by James Swinburne before the Students of the Institution of Electrical Engineers.

The chief difficulty in connection with an address is deciding what it is to be about. The obvious thing in an address to students is to give fatherly advice. Anyone wanting good advice can find lots of extracts of wisdom in the writings of the ancient Orientals. None of the Eastern sages gives advice that is specially applicable to the electrical engineer wishing to rise in his profession, so I think I may try to say something useful. I therefore propose to talk to you about a few of the difficulties in getting on.

The first difficulty is to know what equipment is necessary, and how to get it. That is to say, to know what ought to have been learnt, and how to make up any deficiencies. In engineering it is quite impossible for anyone to start out with a definite career before him. A man who has made a specialty of electric waves, gets his first appointment as inspector of meters to an electric light company, and so on. A well-known engineer remarked to me the other day, that he found his knowledge of differential equations, and his experience in the accurate analysis of the rare earths, was of little use in putting in sewage plant. Yet he had made lots of use both of his mathematical and chemical analysis in his time. Probably each man should have a general knowledge of applied physics and chemistry and mathematics, and a special knowledge of one or two subjects. The special knowledge may never come in useful; but the chances are that in the blind stumblings we call our careers, a specialty may be very valuable.

One of the great difficulties is to keep knowledge in a polished state ready for immediate use. In practice it may have to lie idle for long periods and then be wanted very much on short notice. This fact is overlooked by people who suffer from the modern craze for writing about technical education. For instance, we are told that all engineers ought to have the calculus at their finger ends, and so on; but it is forgotten that though an engineer ought to be well up in mathematics, he only makes a calculation requiring higher mathematics once in several years, perhaps; and it is impossible for him to keep his mathematics in working order down to minute details. All he can do is to keep general principles in his mind. The



$$\begin{aligned} X &= a \cos A \\ X1 &= X \cos A \\ X2 &= X1 \tan A \\ X3 &= X2 \tan B \\ X4 &= b \sin B \\ X5 &= X4 \tan B \\ X6 &= X5 \cos X \\ X7 &= X2 \sec B \\ X8 &= X \sec V \\ X9 &= X5 \sin I \\ X10 &= X5 \tan B \\ X11 &= X12 \sin A' \\ X12 &= a \cos A' \end{aligned}$$

$$\begin{aligned} Z &= X - I; Z' = X' - I' \\ \tan P &= c \div d \\ \tan I &= a \div e = \tan A \cos B \\ \tan V &= X3 \div X = \sin A \tan B \\ \tan X &= X7 \div X1 = \tan A \sec B \\ \tan M &= X6 \div X4 = \tan B \cos X \\ \tan G &= X9 \div X4 = \tan B \sin I \\ \tan V' &= X13 \div X12 = \sin A' \cot B \\ \tan X' &= X15 \div X14 = \tan A' \div \sin B \\ \tan M' &= X16 \div X10 = \cot B \cos X' \\ \tan G' &= X9 \div X10 = \cot B \sin I \\ X13 &= X11 \cot B \\ X14 &= X12 \cos A' \\ X15 &= X13 \sec B \\ X16 &= X5 \cos X' \end{aligned}$$

A = Angle between transept roof and horizontal plane.
B = Angle between lines cut from horizontal plane by plane of web of hip and by plane of transept truss.
I = Angle between valley rafter and horizontal plane.
A' = Angle between main roof plane and horizontal plane.
X = Angle between the plane of the purlin and the valley rafter.
V = Angle in plane of web of purlin between normal to center line of purlin and line cut from plane of web of purlin by plane of web of valley rafter.
G = Angle between roof plane and plane of back of valley rafter, perpendicular to web of valley rafter.
Z = Angle between line cut from plane of web of valley rafter and perpendicular to center line of valley rafter.
M = Complement of angle between hip and purlin planes, giving bevel of bent plate on purlin.
X' = Angle corresponding to X but on other side of valley rafter.
V' = Angle corresponding to V but on other side of valley rafter.
G' = Angle corresponding to G but on other side of valley rafter.
Z' = Angle corresponding to Z but on other side of valley rafter.
M' = Angle corresponding to M but on other side of valley rafter.
P = Angle in plane of transept roof between planes of transept truss and valley rafter.

DIAGRAMS AND FORMULAS FOR USE IN DESIGNING HIPs AND VALLEYS.

The writer has studied the information on blue prints, and the published articles in the various engineering magazines, but the objection in either case is that the published articles are very lengthy in explanation, and the blue print information is scattered about on several sheets, both taking considerable time to go over. As a result, the present set of formulas has been compiled in a simple and concise manner, a dominating feature being that it is

ing truss; distance d is the length of the transept truss rafter; and distance e is the length of the valley rafter projected on the horizontal plane. The purlin planes have been passed through the points shown for simplicity, for then the edge in the horizontal plane is coincident with the center lines of the transept and main building trusses, respectively, thereby facilitating calculations.

The most difficult angle for the draftsman

great thing is to master a certain number of broad fundamental principles which give a starting point for refreshing old knowledge or acquiring new.

In science and technical training the same unavoidable evolution toward the impractical is always going on. It is but human to glorify one's own office. The result is that the attitude of the science teacher in this country is that of a real though unavowed antagonism to the scientific development of the industry of the nation. Science, for which no use has been found, or which is not applied, is called "Pure Science," whereas it is really the raw material, and should be called "Raw" or "Crude Science." There is an assumption of superiority in the term "Pure Science," and generally the term "Science" is appropriated by workers in raw science in much the same way as the term "working man" is appropriated to the exclusion of brain workers. There is supposed to be something noble and superior about "Raw Science," and its study is treated as the unselfish devotion to the interests of man, which is obviously entirely the wrong way round. The so-called "scientific man" thinks that engineers and manufacturers are ignorant and unscientific, and that their practical knowledge is of no account; and that the cure for all industrial evils is more technical education, more universities and more power to the science masters. Though there are in existence a few practical science teachers they are rare. Perhaps no one would be more surprised than the average science master if you told him he was impractical, and was, by his attitude and example, hindering science. He does not mean to. He is as keen as possible to do just the reverse, and is generally exceedingly anxious for the spread of science or technology—but, unfortunately, he has got a wholly wrong view of the relations of science and business. There is no more baneful influence on the technical advancement of this country than the Royal Society ideal in science.

If you look round the electrical industry, or round the industries generally, who are at the top? Always the business men. The men at the head of large industries generally know very little science. A man may run a large electrical industry with the most vague ideas as to the true relation of the electrostatic and electromagnetic systems of units; in fact, he may think power, force and energy are very much the same kind of thing if looked at in a broad, common sense way without any scientific prejudice. If he wants good technologists he employs them. If he wants practical men who can take commercial responsibility he pays good salaries; if he wants men full of book knowledge he pays low salaries, but he does not generally want them. Raw scientists, to coin a horrible word for a most estimable class, tell him he knows nothing about science, and therefore does not know how to run a scientific business, and tell him to subscribe to universities, which are so inefficiently worked that they have to beg, like hospitals, and to employ young men from the technical colleges. He either takes no notice or he gets annoyed at their superior attitude, and discharges a couple of scientific men and puts their saved wages toward the salary of a new practical chauffeur, and enjoys himself.

If you examine the large industries you will find the commercial or business man with little or no technical knowledge at the top of the tree. If you confine your attention to engineers, you will find the engineers who make the biggest incomes and occupy the most important and responsible positions are those who have most business or practical knowledge. Our leading consulting engineers do not spend a

large portion of their lives plotting curves, counting electrons, or even making anything more than arithmetical calculations. They spend their time dealing with large questions on purely commercial lines; and as a rule the bigger the engineer the more he knows about practice and business, and the less he knows about text book science. I do not for a moment mean to say that text book science is not of priceless value; of course it is; and the more scientific knowledge you or I, or still more, the leading engineers have, the better; but most of us suffer from too little common sense in proportion to our scientific knowledge.

The engineers occupying smaller positions, assuming the same age in both cases, are not necessarily deficient in technical knowledge; but they are generally wanting in business attainment and less able to take responsible positions. There is a wide distinction between the man who can earn a few hundreds a year and the man who earns as many thousands. It is a very curious thing that there is hardly anything between. A given man will either earn his few hundreds a year all his life, remaining permanently an assistant, or he will undertake responsible work and get into fair figures. The engineer who is worth £750 a year seems hardly to exist, except for a short time on his way from one class to another. This is what is meant by saying that there is plenty of room at the top of the ladder.

When I say that a man's earnings is a rough test of his value to the world, a great exception must be made in the case of genius. A genius does not work for a given employer; he works for the world at large; and the world at large does not pay him. It would be ludicrous nonsense to say that the value of Newton or Faraday could be reckoned in terms of their pecuniary earnings. They did grand work, apparently because they were impelled to it without any selfish motive. This is true of the great scientific men of to-day.

In the charter of the Institution of Civil Engineers the engineer is defined as "Directing the Great Sources of Power in Nature for the use and convenience of Man." With all respect to this august body, and their often quoted definition, I would humbly suggest that it is inapt. It is really the definition of a scientific man. It is incomplete as applied to an engineer, because it does not take into account the sordid element of price. An American definition is much better: "An engineer is a man who can do for one dollar what any fool can do for two." This is not poetical and is useless for oratorical purposes; but it is right. It is no use being able to design most complicated alternating-current machinery, or being able to explain it with the help of a wilderness of clock faces and several issues of the technical journals, unless the machinery, when made, is cheaper than its rivals. Every design, every engineering manufacture, and every piece of engineering is only a question of price. It is unpleasant, perhaps, but it is a hard fact, and we have got to face it. If one of us does £150 worth of work a year, and earns £100, he is efficient; if he only does £90 worth, he is an inefficient machine, and will come to grief.

Views like these put forward in addresses do not alter the world at large, and they are not expected to do so. They are put strongly to warn you, who are young, and therefore inclined to be enthusiastic, against one of the greatest difficulties in getting on; that is to say, a poetic idea that there is something degrading or deteriorating in taking a money view of everything. You may say, "We take higher views of life than that; there is something better for us in our careers than money grubbing." So there is; I heartily agree with

you; and when you have grubbed some money and are at liberty to attend to higher things, I would like to be allowed to join you.

Then as to the different branches of the business—business is really a higher title than profession—in which you are to find openings? From the number of applications I receive from young fellows, it seems to be a common idea that consulting engineering is a good thing to begin upon. This is a curious notion. A consulting engineer is supposed to be a highly skilled engineer, with so much experience that he is an authority. I should have thought at least 20 or 30 years' experience, apart from school and college training, was necessary for a consulting engineer to be worth his salt. But there are various grades of consulting engineer; and I am entirely at a loss to know what the qualifications of the consulting electrical engineer really are. Then still less do I know what the consulting electrical engineer will be by the time you have had 20 or 30 years' experience. At present most of the large towns are electrically lighted, and have their tramways; railways will be electrified by that time, and it is probable the work will be done by their own men. Supervising contractors who are doing wiring will not be much of a profession in 20 years; and if that is consulting engineering, I do not think 20 years training is necessary.

In manufacturing work there is the designing of dynamos, motors, transformers, and so on. This was considered high grade work when I was a young man; and even very able men built some very queer machines in those days; and we were all pretty ignorant. But the works were smaller then, and salaries for dynamo designing were not princely. But now there is not much opening in electrical machine designing. There is some, of course, but it is not as it used to be. There are many openings to be had in central station work; and stations are growing bigger and more important every day. At present there are also many applicants for every opening. Central station work in a position of responsibility is very anxious. I do not think it is very well paid, either. You will find exceedingly able engineers in most of the large town stations; and I am sorry to say their incomes are often very small for men of their technical and commercial ability. The assistants are often poorly paid, especially, I think, in municipal stations.

A large number of young men go in for installation work, which sounds as if they started bishops on their episcopal careers, but really means that they do what is in fact electrical plumbing, under an unnecessarily imposing name. There are a great many of them, and they seem to spend most of their time going into and out of partnership with one another, like ions, and sending notices round to that effect. At other times they go bankrupt and send no notices. The upper grades in teaching science are well paid, more especially as a position goes with an appointment, and there are time and facility for original research, which is a luxury and brings reputation. Moreover, a steady income with no expenses is a very blessed thing. But the lower grades are very poorly paid in proportion to their ability.

In such a business as engineering a man of first-rate ability may be quite unable to make enough to marry on until he is 30, or enough to be comfortable on until he is 40. An eminent north country engineer, whose name you would all know, though he has been dead some years, said that he did all the hard work of his life for 30s. a week, and when he was well on in life money came rolling in of its own accord. I have reason to believe that one of our foremost engineers, now dead, never made £500 a year until he was over 40.

CURRENT NEWS SUPPLEMENT

JANUARY 7, 1905.

DIRECTORY OF NATIONAL ENGINEERING SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Chas. Warren Hunt, 220 West 57th St., New York. Annual meeting, New York, Jan. 18 and 19.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, F. R. Hutton, 12 West 31st St., New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 95 Liberty St., New York.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 99 John St., New York.

AMERICAN INSTITUTE OF ARCHITECTS. Secretary, Glenn Brown, Washington, D. C. Annual convention, Jan. 11 to 14 at Washington.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, John C. Trautwine, Jr., 257 South 4th St., Philadelphia, Pa.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 35 Water St., New York. Annual meeting, Hotel Astor, New York, Jan. 17-19, 1905.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. M. S. Cetchum, University of Colorado, Boulder, Colo.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. Secretary, S. F. Paterson, Concord, N. H.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

AMERICAN WATER-WORKS ASSOCIATION. Secretary, J. M. Diven, Elmira, N. Y.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, P. O. Box 432, New York.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

PUBLIC IMPROVEMENTS IN NEW YORK CITY.

EXTRACTS FROM THE ANNUAL MESSAGE OF MAYOR MCCLELLAN.

Public Lighting.—I am in favor of municipal ownership and operation of an electric lighting plant to light the streets, parks, and public buildings of New York.

I do not believe that Government should engage in any service which can be done better or as well by private enterprise, or should invade business fields in competition with the legitimate trade of the citizen. Where service rendered by private corporations is unsatisfactory, either because of its inferiority or excessive cost, it becomes the province of government to take control of that utility for its own uses. The prices which the city is compelled to pay for gas and electric light are so out of proportion with the charges in other cities that they must be extortionate. No relief is in sight, as there appears to be an absence of real competition.

This matter has received the attention of the Board of Estimate and Apportionment, and at its last meeting, after hearing the opinion of the Corporation Counsel and Judge Dillon, a commission was appointed consisting of Prof. George G. Seaver, of Columbia University; W. T. Cary Hutchinson, electrical engineer, and Nelson P. Lewis, the engineer of the Board of Estimate and Apportionment, and instructed to report, as soon as possible, general plans and estimates of cost for a municipal lighting plant for the streets, parks, and public buildings of the city as a whole, by boroughs and by districts. This

project, if decided on, will be greatly aided by the use of the rights reserved in grants heretofore given to the Consolidated Telegraph and Electrical Subway Company and the Empire City Subway Company, and by virtue of which these companies have constructed and now maintain their conduit systems. Section 4, Paragraph 3, of the agreement of May 15, 1891, is as follows:

"Said party of the second part shall without charge supply to the City of New York all space in said subways, conduits, and ducts, necessary for its electrical conductors, and the electrical conductors of each separate department of said city which may now or hereafter be required."

Here we have the right to the free use of the conduits in which to place wires for the transmission of electrical currents. This right removes from the discussion a large element of expense, and seems to leave it open to the city, even if it should not build its own generating plant, to perhaps secure in the open market the electrical current, conveying it, if necessary, from localities outside the City or State of New York.

I do not apprehend that the matter of purchasing the lamps and poles now in use or, if that be inadvisable or unprofitable, supplying others in their stead, would offer any serious problem.

In connection with this subject, it is suggested that still another economy may be effected by the utilization of the waste and refuse collected by the Street Cleaning Department, for this, it is urged by competent authority, will very likely generate all the current needed for lighting in streets, avenues, parks, docks, and public buildings of the entire city.

The experience of many cities and towns in England, Ireland, Scotland, and Wales has demonstrated that their lighting has been made possible by employing their mixed refuse as fuel for the making of steam, which in turn is utilized in the generation of electric currents. The process calls for well-designed, well-built and intelligently managed destructors. The incinerator used by the Street Cleaning Department in West Forty-seventh Street, where a current is generated for lighting the stable and dock, shows the practical results that are obtained even on so small a scale.

Data has been furnished showing the very considerable extent to which this method is carried, especially in the cities of England, and the actual product per ton of refuse. The borough of Woolwich, in London, has recently established a destructor, and in connection with it a complete electrical equipment, which is in practical operation. Brentford, with one small destructor, erected four years ago, and burning only fourteen tons of refuse in twenty-four hours, pumps 600,000 gallons of sewage in that time, besides supplying light to the stable and plant. Gloucester lights its streets with its waste, using no other fuel. Liverpool utilizes its refuse in the same way. In Sheerness the destructor plant is within eight feet of a public school, and is so inoffensive as to cause no complaint.

There are scores of illustrations in Great Britain of the successful operation of these plants. With 5,500 tons of refuse gathered daily by the Department of Street Cleaning—twice the per capita quantity collected in London—New York has a power-producing fuel that should be used profitably. It would seem feasible, therefore, to settle two propositions at the same time—that of municipal lighting and that of utilizing the city's waste as fuel for the generation of electricity. The subject is an interesting one, and it is hoped that it will receive careful consideration by your honorable body.

While the right and authority of the city to establish and maintain a plant for supplying light to the public streets and buildings appear from the recent opinions of the Corporation Counsel and Judge Dillon to be settled, it may be that when such a course is determined upon interested persons may resort to vexatious litigation to retard or defeat if possible the proposed plan. For the purpose of removing even the semblance of a hope of such a result, I have caused to be prepared a measure for introduction in the

Legislature about to convene. This measure will be simply declaratory of the right and power already existing in the city, but its enactment may prevent so-called tax-payers' suits by which private interests may seek to impede the institution of a public improvement.

Water Supply.—The numerous evidences of the city's amazing development which give so much satisfaction to the people, suggest at the same time important plans for the future. Our trade, commerce, and population grow at a rate that makes calculations on the future of New York mount into stupendous figures. The progress of to-day must make provision for the greatness of to-morrow. The rapid transit system planned but four years ago has already been overtaken, and we have been put to new projects to keep pace with our expansion.

Yet there is another problem quite as important, if not as constantly in the public mind as that of transportation. Health and the safety of property—two essentials to municipal advancement—demand adequate supply of pure water. When we have reached the limit of our supply we have reached the limit of our growth. Only last winter New York was warned by legislation which shut off access to desirable watersheds that the solution of this problem will become more difficult with each year's delay. Nor are the physical questions to be met in a day. Expenditures now to secure our supply will, I feel confident, be regarded as judicious and economical investment when the city of four millions shall have attained ten million inhabitants.

Recently the Board of Estimate and Apportionment received from the Commissioner of Water Supply, Gas and Electricity a report, predicated on the findings of the Burr Water Commission, recommending the adoption of a plan for acquiring watersheds and building aqueducts and mains, roughly estimated to cost \$90,000,000. This report was committed to the three experts, Messrs. Burr, Freeman, and Herring, who had previously made an exhaustive examination into the question in the interests of the city, and their opinions on the recommendation of the Commissioner will be delivered to the Board of Estimate and Apportionment some time this month.

If the city decides to take up the project, I believe the work should be placed in the hands of a commission, and I shall recommend a special enactment by the Legislature thereon. My own view is that the commission will be aided so materially by the mass of information and suggestion now in the city's possession that its preliminary inquiry will be correspondingly shortened and the actual work of construction may begin some time this year.

I believe the enterprise will be safeguarded by constituting a commission in this manner: One member appointed from a list certified to the Mayor by the governing body of the Chamber of Commerce, one member appointed from a list certified to the Mayor by the American Society of Civil Engineers, and the third member to be named by the Mayor. Such a commission should secure the highest efficiency. If correct business administration could be had through a bi-partisan body, I should favor so constituting it, but the experience of the city with a bi-partisan Police Board and a bi-partisan Aqueduct Commission has demonstrated the signal failure and irresponsibility of that method of administration.

The act creating this commission should enable it to so plan its work as to utilize the energy that may be developed from the water power. Since we are at the disadvantage of taking our supply from distant watersheds and piping it down from the higher levels up-State, the water should be made to earn its own passage. Experts have estimated that many millions of horse-power may thus be created and put to many uses to bring revenues to the city. Only an insignificant part of this power, for example, would be needed to provide the energy to light the city with electricity.

This project is as vital to the other boroughs as it is to Manhattan and the Bronx.

Although large appropriations have been expended in almost every variety of improvement and extension, and will be continued on a generous scale, the water supply and service of Brooklyn do not, in consequence, measure up to the standard required for that rapidly developing borough.

Brooklyn's needs are partially supplied by private enterprise. As for that matter, more than half the territory of Queens Borough and almost the whole of Richmond Borough are similarly supplied. The increasing demand of the citizens of those two boroughs for the enlargement and improvement of their water supply service may ultimately result in their being entirely supplied by the city.

Confident that the importance of this whole subject of water supply warrants immediate and affirmative action, and equally confident that the people of this city prefer to handle a proposition of such magnitude themselves, and acting solely in what I believe to be the interests of these five boroughs, I beg to recommend to the public that a commission be created, as I have suggested, with full authority to conduct the undertaking.

Docks and Ferries.—The Dock Department secured from the Legislature of 1904 power to undertake extensive improvements along the East River water front, between Whitehall and Montgomery Streets, and work is now in progress which will give the city the benefit of an adequate marginal street for a distance of 7,089 feet. By this proceeding the number of the city's piers will be increased by twenty.

Three new piers have been completed in the Chelsea section, and two others are in course of construction. The Dock Commissioner wisely recommends that legislation of a similar nature to that covering the improvement between Whitehall and Montgomery Streets be asked for all of the water front of the city of New York, and the administration contemplates the introduction of such a bill at Albany in the interest of our vast and growing commerce.

THE OHIO SOCIETY OF SURVEYORS AND CIVIL ENGINEERS.

The Annual Meeting of the Ohio Society of Surveyors and Civil Engineers will be held at the Great Southern Hotel, Columbus, on Jan. 23, 24, 25, the first session opening at 2 P. M. on Jan. 23.

The programme has not been fully completed. The portion already arranged includes an address of welcome by Hon. R. H. Jeffrey, Mayor of Columbus; addresses by Attorney General Wade H. Ellis on the legal status of the surveyor and civil engineer in Ohio; Chas. Hermans, President of the American Society of Civil Engineers will be present if other engagements do not interfere. Papers will be read by Prof. C. E. Sherman of Ohio State University, on the cooperative topographical survey; by Mr. F. A. Barbour of Boston, Mass., and Col. W. F. Morse of New York, on sewage and garbage disposal; by C. E. Perkins, chief engineer State Board of Public Works, on the canal system; by R. W. Pratt on the work of the Geological Survey in stream gauging; by Mr. L. A. Keith, city engineer, Mansfield, Mr. J. H. Asher, county surveyor, London, and a number of other prominent engineers of this state and elsewhere.

A visit will be made by the Society to the experimental sewage disposal plant of the city of Columbus, where the most exhaustive study is being made of this interesting subject on an extensive scale by a corps of experts specially employed for this purpose. If the weather is suitable the Scioto storage dam now in process of construction will also be visited. The city of Columbus is about to expend nearly \$4,000,000 in these improvements.

A feature of this meeting will be a social session, either a banquet or smoker as later decided. It is believed that an opportunity for good fellowship and closer acquaintance among the members will be of much benefit to all.

Further information can be obtained from Sec'y E. G. Bradbury, 85 North High St., Columbus, O.

TURBINE PUMPS FOR IRRIGATION AND DRAINAGE.

Extracts from a paper by J. J. Brown, M. Am. Soc. M. E., before the Engineering Section of the Twelfth National Engineering Congress.

One of the most noteworthy results of irrigation in this country is to be seen in the great rice belt extending from Teche in southwestern Louisiana to westward of Houston, Texas. This immense tract of land comprises in all 610,000 acres under cultivation, a large part of which was practically barren a few years ago. The territory in the Carolinas and the Georgia and Louisiana Basins, which heretofore has supplied our rice, comprises 84,000 acres. A comparison of the two acreages will give an idea of the magnitude of recent developments through irrigation. The capital invested in the rice industry of the Louisiana-Texas belt is estimated at \$30,000,000.00, which includes lands, improvements, implements, pumping plants, mills and canals. The yield in this belt during 1903 netted a sum exceeding \$15,000,000.00 and the great possibilities of this territory have attracted the attention of enterprising Japanese capitalists, who now have several projects under way involving the introduction of Japanese methods on a large scale.

By those who have not investigated the question thoroughly, the relative expense of developing land by gravity and by pumping systems is usually wrongly estimated. As a matter of fact, even where the cost of power is high, water can often be procured cheaper by pumping than through gravity canals. A compilation of seven instances where water is obtained through canals in Lower California shows that one-seventh of one miner's inch constant flow per acre of land for six months, making a total of 333,152 U. S. gals. per acre, or 12 in. of depth of water placed on the land, costs a minimum of \$1 and a maximum of \$8 per year, the figures being calculated on the basis of 25,000 acres.

For purposes of comparison let us assume that one-seventh of a miner's inch constant flow for six months is the quantity of water required and figure on machinery in duplicate (so that in case of accident one-half of the machinery only will be stopped), which will raise at least 32,000 gal. of water per minute 12 ft. high, adding the operating expenses running night and day. A first-class plant will cost \$30,000 and the annual expenses, including interest, will be \$15,220 per year, or 60 cents per acre, showing a net saving of 40 per cent. over the lowest cost of irrigation by gravity.

Water for irrigation may come from streams, rivers, springs, lakes or wells. The conditions may require large volumes to be pumped long distances, where the head is chiefly due to friction, or the water may be pumped from bored wells or rivers to considerable heights above the source of supply. The supplying of water to rice lands shows the wide field that such problems cover. One tract in Louisiana is supplied by pumps having a capacity of 80,000 gal. per minute, all the water being used on 700 acres, as an immense surplus is needed to supply the loss by seepage through the old levees. These, however, will be thoroughly puddled and water-laid by the ensuing year, when it is estimated that the same supply will cover 10,000 acres. In this case, as in the majority of cases where water is obtained from bayous, the head is very low, the extreme height being 31 ft. above drainage level. But beyond the reach of canals from the bayous, water is procured from driven wells, which vary in depth from 150 to 250 ft., the water being obtained from a sand and gravel stratum 30 to 40 ft. in thickness. These wells care for from 150 to 250 acres. Comparing two paying pumping installations located in Louisiana, one plant furnishes water for 150 acres, while a few miles distant there are three plants which have collectively 276 pumps feeding over 800 miles of main canals and watering an area of approximately 560,000 acres.

In parts of Texas, pump irrigation is meeting with marked success. At the plantation of the Matagorda Co., of Bay City, two 36-in. centrifugals were installed three years ago. These pumps deliver 64,000 gal. per minute 12 ft. high. The water is drawn from the Colorado River, and contains a considerable percentage of sediment and the lift varies with the rise and fall of the river. The pumps are connected by means of rope gearing with a pair of compound condensing engines.

On the Brazos River, the Brazoria Rice & Irrigation Co. have a 36-in. centrifugal, which

is located in a masonry pit and delivers 35,000 gal. per minute against a head of 48 ft. The engine driving the pump is at the surface, and connection is made by means of a rope drive at an angle of about 45 deg. The suction lift of the pump, including the friction of the long suction pipe, is at low water about 25 ft., but no trouble has arisen from this high lift. The pump handles water containing a large percentage of sharp sand. No provision has been made for the protection of the intake since the time the pump was installed and, as a result, a considerable amount of quicksand from the surrounding hills has been drawn into the suction pipe and a number of landslides have resulted. During the first two weeks after installation the canal was practically filled with sand for a distance of several hundred yards. Enormous quantities have been delivered into the canal, probably amounting to several thousand cubic yards. At times the Brazos River rises 20 ft. above the pump and puts such a pressure upon the stuffing boxes that some of the grit finds its way into the bearings. Although the pump has been in use three years, no repairs have been necessary, and an efficiency of about 70 per cent. has been maintained. The company has recently installed a second centrifugal pump, which has a suction lift of 12 ft.

Pump irrigation in the Salinas Valley of California has been developed very profitably over a considerable area. At the Spreckels sugar plantation 3,000 acres are irrigated by means of an 18-in. centrifugal pump directly connected to an induction motor. The water is taken from the Salinas River, and the total lift averages 30 to 50 ft. Another plantation is owned by the same company, where 500 acres are irrigated by a centrifugal

daily; in Kauai, 55,000,000 gal. daily, and in Hawaii, 7,000,000 gal. The majority of the pumps have been installed for some time and are of the reciprocating type, but the new installations are entirely high-speed centrifugal pumps. In several cases shafts have been sunk 200 to 300 ft. to the water level and directly connected pumps with long vertical shafts reaching to motors at the surface have been installed.

For irrigation from bored wells, the best system is to lower a vertical multi-stage turbine pump into the well, the long vertical shaft being arranged in sections so that the pump may be lowered as the water level recedes. The top of the shaft may be driven by either a vertical-shaft motor or by belt from an oil or steam engine. This system is now in extensive use in Lower California, where the wells are sometimes over 500 ft. deep. Horizontal belt drives are not as a rule satisfactory, due to moisture causing the belt to slip and stretch, but when a vertical shaft is employed and the belt arranged wholly above ground, very efficient action may be obtained.

It may be interesting to note that centrifugal pumps are being used very extensively in processes the reverse of irrigation. In localities where the land is flooded, or the ground saturated through infiltration, rendering cultivation impossible, levees are built enclosing the section to be drained and pumping plants are installed. The usual system is to locate the plant permanently on piles or on ground higher than that to be drained, and by ditching the land radially bring the water to a central canal, from which it is drawn by the pumps. One method of installation, where islands are to be drained, is to mount the pump on a floating scow, together with

used in an irrigating plant in Louisiana gave a mechanical efficiency of only 30 per cent. In the new type of centrifugal pump careful and scientific design has made it possible to guarantee high efficiency and as high as 80 per cent. has been obtained under test. This very important point should be carefully investigated by the purchaser, as an inefficient pump can easily eat up its cost in power in a single season, the more so, since the cost of power in irrigating districts is usually high.

DOUBLE CHORD BORING MACHINE

The double chord boring machine shown in the accompanying cut consists of two machines fitted to a long base, on which both machines have a power traverse, the base being 66 ft. long and 6 ft. wide, to give 60 ft. between centers, with three bearings, each 10 in. in width. The spindles are 6 in. in diameter and have an automatic feed of 30 in., with four changes and quick return by hand. The spindle shell is driven through a steep lead worm and worm wheel and gearing by 10 h.p. motors. The maximum distance between the center of spindle and the adjustable knee or worktable is 26 in. When desired the adjustable knees or worktables may be removed and the knee bolted to the bottom worktable, which has a maximum distance to the center of spindle of 38 in. The maximum distance between the nose of the spindle and the inside face of the outboard bearing is 6 ft. 6 in.; the end of the bed is planed so that an extension can be bolted, giving a greater distance between the end of the spindle and the outboard bearing. The adjustable knee or worktable is 28 1/4 in. wide and 8 ft. 4 in. long, and is raised and lowered by hand, the planed slots being provided for clamping yoke. The machine has been built by the Newton Machine Tool Works, of Philadelphia, for bridge and structural steel shops.

STEAM TURBINES FOR NEW BALTIMORE ELECTRIC POWER SYSTEM.

An interesting feature of the recently announced developments in the Baltimore electric power enterprise is the exclusive adoption of steam turbines as the prime mover. A contract recently closed with The Westinghouse Machine Co. provides an initial equipment of 4,000 kw. in two generating units of 2,000 kw. each. A Westinghouse electrical equipment, complete and modern in every particular, has also been contracted for.

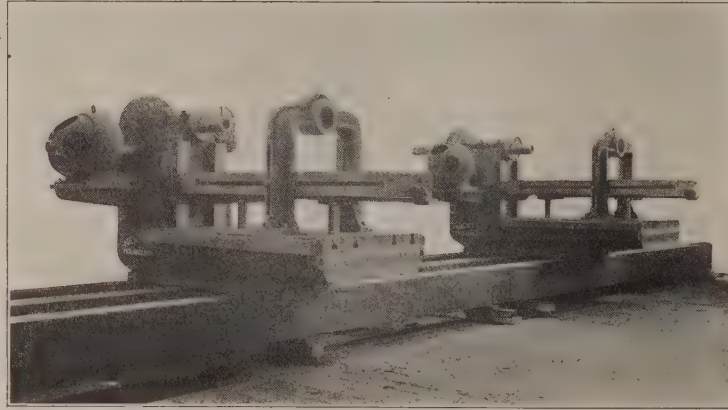
Officers of the company state the power plant will embody the latest developments in steam and electrical engineering. The building is to be of fireproof construction throughout, the structural steel frame also serving as support for the boilers and the overhead coal bunkers. Being located outside of the congested districts of the city, all the boilers and heavy machinery will be on the ground floor. Floors and roofs will be of steel-concrete construction.

The company has secured a lot fronting on Gould St. and extending to the Patapsco River. This property comprises 6.4 acres and by filling in to the wharf line, over 3 acres will be added to the area, which will give the company sufficient space to take care of the electrical needs of Baltimore for a long period. The location of the plant on the water front, with the Baltimore & Ohio and Wabash R. R. systems adjoining, affords ample facilities for securing coal either by rail or water. The distance from the center of the city to the new power house is about 2 1/2 miles.

The steam turbine plant will operate with a boiler pressure of 175 lb. and a superheat of about 100° Fahr. A high vacuum condensing system will be installed, capable of sustaining a vacuum of 28 in. at full load on the plant.

The plant in its entirety has been designed on the separate unit plan, which virtually consists of a number of distinct power plants placed side by side, each entirely separate from the other, but each capable of helping out the other in case any link in the system should be disabled. This holds good throughout the coal-handling apparatus, the boilers, steam piping, turbines, condensers, generators, switchboard, underground cable, etc., from the coal pile to the customer's building. In addition to this precaution against interruption of service which is thus insured, the company will install a large storage battery which will ordinarily float on the system.

The Baltimore Electric Power Co. was recently organized with an authorized bond



NEWTON MACHINE TOOL WORKS DOUBLE CHORD BORING MACHINE.

pump. The average cost is \$2 per acre per year, running 12 hours, the fuel consumption being 1/2 cord of wood per acre irrigated. At the Soledad ranch the cost for irrigation by centrifugal pumps is \$2.50 per acre. Pumps are used with a capacity of 8,000 to 10,000 gal. per minute. The Soledad Land & Water Co. irrigates with a belted centrifugal pump working against heads varying from 14 to 31 ft. This plant irrigates 800 acres and cost \$10,000, net, including ditching. In the lower Salinas Valley there are many small pumping plants which pump from deep wells by means of centrifugal pumps and gas engines, the crops being alfalfa, potatoes and vegetables. The aggregate area is approximately 2,600 acres.

In the Hawaiian Islands irrigation has developed a great deal of land that was arid and unproductive, sugar cane being the most extensive crop. Over 2,000 tons of sugar were produced on this land last year, netting the growers \$14,000,000. Both gravity and pumping systems are used in the Hawaiian Islands, the latter being necessary in most localities. In the Island of Oahu, which is 12 miles wide and 35 miles long, about 300,000 gal. of water are pumped each day from wells reaching a stratum 400 to 800 ft. below sea level. In other islands the water is taken from sumps excavated 5 to 8 ft. below sea level. The pumping plants are usually fed from 12-in. wells 50 ft. apart, each well pumping 1,000,000 gal., ten operating continually, and two being held in reserve. The highest head pumped against is 450 ft. In Waianae a waterfall in the mountains supplies electric power, which is used in pumping near the sea level, directly-connected pumps being used to lift water 15 ft. In Maui the pump capacity is 140,000,000 gal.

a steam or oil engine, and then use a flexible connecting pipe of sufficient length to reach any part of the land, floating the scow around the outside of the dike. However, this arrangement is applicable in a comparatively small number of cases. The cost of draining the land in this way depends, as it does in irrigation, greatly upon local surroundings.

Reclamation is being carried out on a large scale along the San Joaquin and Sacramento Rivers in California, which have very little fall for the first 200 miles of their courses. Levees have been built and large pumping plants of 34-in. to 48-in. belted centrifugal pumps having a capacity of from 10,000 to 40,000 gal. per minute have been installed in a number of places.

About 2,000,000 acres of the land in Louisiana jutting out into the Gulf of Mexico and forming the Mississippi Delta were covered a short time ago by cypress swamp. This land is rich alluvial soil of sedimentary origin and northern investors became interested in it, 1,200,000 acres passing into the hands of one concern alone. Reclamation work was carried on by ditching and pumping until it is now fertile and productive. The reclaimed land has an advantage over naturally drained land; for any degree of moisture can be obtained when desired in dry seasons by gates and dams.

Low efficiency has prevented the general adoption of centrifugal pumps until recently. It is even stated by William Kent in his "Mechanical Engineers' Handbook" that a lift above 17 ft. has not been obtained with a centrifugal pump with any degree of efficiency, although makers have claimed 65 to 70 per cent. for lifts of 12 to 18 ft. Indeed, a recent test on one of the older types of pumps

ue of \$7,500,000 and a capital stock of 500,000. The officers of the company are: E. Evans, President; R. F. Bonsall, Treasurer; W. T. Spring, Secretary. Pending a permanent organization, the directors of the company are H. W. Webb, D. E. Evans, W. T. Stone, W. T. Burroughs, R. F. Bonsall, W. T. Spring and George R. Webb.

The construction work is already under way and will be pushed as rapidly as possible in order that the plant may be complete in all respects and running smoothly by July next.

THE SARGENT GAS ENGINE.

Some weeks ago, among the notices of trade publications, mention was made of the fact at the Wellman-Seaver-Morgan Co., of

burning gases, turning the heat into work instead of throwing it away in the exhaust, a lower terminal temperature and consequently a lower average temperature of the cylinders is maintained throughout the cycle. For this reason engines of this type below 100 h.p., it is emphasized, require no water-cooled pistons or rods.

The mechanism of the Sargent gas engine is particularly simple. A side shaft driven by the crank shaft and governor through a pair of worm gears running in oil, carrying two cams for each explosion chamber, one for the igniter and one to operate the valve, comprises all the moving mechanism except the valves and lever, as shown in the general view, the other side of the engine being plain.

main in normal position during compression, ignition and expansion or until the point *L* on the cam pushes the roller down and the piston up, which opens the poppet and the exhaust gases pass out through the ports *K*, and the elbow, *W*, to the exhaust pipe under the floor.

The poppet valve seals the opening in the combustion chamber during compression and inflammation and the piston valve holding against no pressure, works loosely in its bushing, cutting off the admission and guiding the exhaust. As the poppet valve controls both the inlet and outlet gases, both the valve and seat keep cool and, it is stated, need to be ground not over once or twice a year. By revolving the piston valve by the index wheel, the blind port, *S*, varies the mixture to suit the gas whether it has 100 or 1,000 B.t.u. per cubic foot.

The speed of the Sargent engine is controlled by the well-known Rites inertia governor in the fly-wheel, which advances the valve shaft in time ahead of the crank shaft, as the speed increases, thus diminishing the mean effective pressure with the load. As the load gets lighter, the cut-off becomes earlier, taking less of a constant mixture of gas and air into the cylinder, but as the burnt products in the clearance do not get less, the mixture gets weaker and slower burning. If the ignition were at the same point as at full load, the highest pressure would not be obtained till the piston approached the middle of the stroke, where the cooling surface is so increased that the greater part of the heat goes into the water jacket rather than into the work. In the Sargent engine, the time of ignition advances with the cut-off, getting earlier as the mixture gets weaker, thus maintaining the highest pressure at the beginning of the stroke, irrespective of the load.

While the governor controls the speed through all ranges of load, the gas engine, like the steam engine, is not economical with very light loads. Where a variation in the turning moment is not objectionable, one or more of the explosion chambers may be cut out at will by the engineer by simply raising to horizontal position a controlling lever, which holds the exhaust open and the gas and air closed. This is desirable in blowing engines, as they can be designed so that two explosion chambers will furnish air at 15 lbs. and the four chambers at 30 lbs. pressure.

CALENDARS FOR 1905.

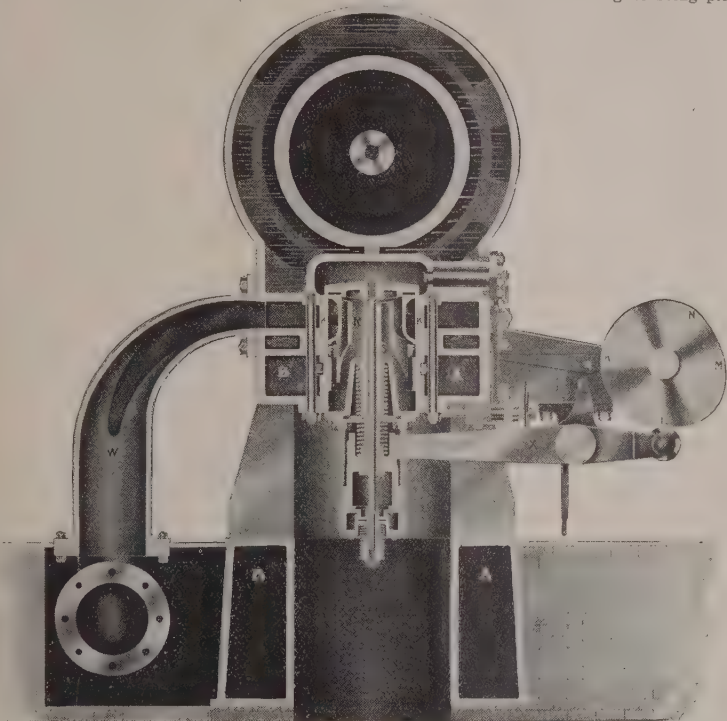
The number of calendars issued this year seems to be greater than usual, and some of them are very attractive. The Springfield, O., Gas Engine Co., has one containing a well-worked up portrait of Maxine Elliott, which has unusual artistic merit. The G. Drouvé Co. of Bridgeport, Conn., makers of

conspicuous manner in which the company's name and connection with the centrifugal pump industry is printed. The Cleveland Pneumatic Tool Co., of Cleveland, O., has used in its calendars for 1905 two handsomely lithographed heads of women, a style which it has adopted for several years, and carried out in a very artistic manner. The Terre Haute Brick & Pipe Co., Terre Haute, Ind., has issued a calendar containing a nearly full-size engraving of the Terre Haute paving block.

The M. F. calendar sent by the advertising department of the American Sheet & Tin-Plate Co., Pittsburg, "to any person who will write plainly his name, business and address on a postal card," is a novelty both in appearance and in the amount of information furnished attractively on the calendar, concerning roofing tin. The largest calendar received to date is from the Bonneville Portland Cement Co., Land Title Building, Philadelphia. The calendar proper is in such large figures that it is particularly adapted for use in rooms of considerable size, for which most calendars are unsuited. The Climax Road Machine Co., Marathon, N. Y., has published a calendar of the panel type, representing a handsomely executed piece of burnt-wood drawing, "The River Road." The Warren-Ehret Co., Philadelphia, have issued a large wall calendar bearing a conspicuous statement concerning the Ehret slag roofing. The Troy Public Works Co., Utica, N. Y., has a beautiful color reproduction of one of W. R. C. Watson's Scotch landscapes as the decorative feature of its calendar. The Vulcan Iron Works, Toledo, O., have again issued a calendar with a large illustration of a steam shovel and a picture of steam shovel work in a deep cut.

In this connection reference should also be made to the excellent pocket diary prepared by the Westinghouse Electric & Manufacturing Co. The diary proper is large enough for most purposes, while the engineering data give valuable information in condensed form concerning train resistance, car heating, drop in line and rails, electric motors for driving various machine tools, Nernst lamps, Cooper Hewitt lamps, arc lamps, line losses, alternating current and other formulas, wire tables, lightning arresters and choke coils, hints on operating electric apparatus, rules for giving first aid to the injured, notes on boilers and various fuels, the performance of gas engines and the performance of steam turbines. There are also tables of the population of various cities, weights and measures, interest laws in different states, and similar commercial memoranda. There are also maps of the United States, Cuba, Porto Rico and the Philippines.

Henry R. Worthington, 114 Liberty St., New York, has issued a 132-page book describ-



CROSS-SECTION OF GAS ENGINE SHOWING VALVE ARRANGEMENT.

Cleveland, O., had secured the exclusive right to manufacture the Sargent gas engine.

As explained in that connection this is a prime mover of more than passing interest, being in its general characteristics, a double-acting tandem engine, designed to expand the burning charge practically to atmospheric pressure, to vary the point of cut-off of the admission inlet with the load and to advance the time of ignition as the mixture gets weaker and the inflammation slower. The advantages aimed at are increased efficiency, increased regularity in speed and smooth running under early cut-offs. It is now intended to describe its operation at some length and the accompanying illustrations have been prepared.

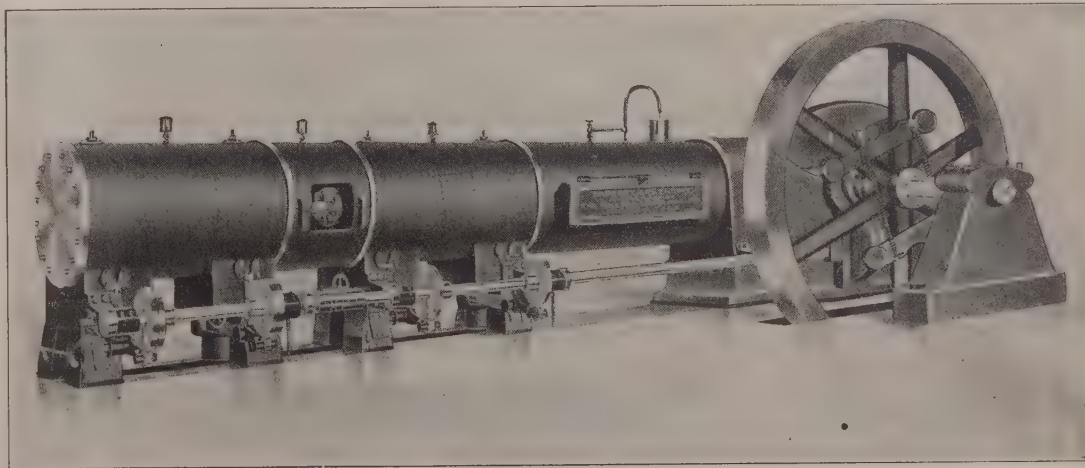
The general design, as shown in the view of the assembled engine, is such that the strains come in a straight line, yet the free expansion of the cylinders and rods is provided for. The sub-base, the top of which comes flush with the floor line, extends from end to end of the engine, thereby giving a flat planed surface upon which the engine is easily erected and aligned. The sub-base and main frame are bolted to the foundation, and the crosshead guides, cylinders and distance head, which fasten to the main frame, can come and go as the temperature varies, sliding on hollow supports rising from sub-base, which not only maintain the cylinders in line, but convey the gas and air from the hollow divided sub-base to the expansion chambers, thus doing away with unsightly, obstructing pipes.

The admission of gas and air at full load is cut off from five-eighths to three-quarters of the admission stroke, depending on the fuel used, which after compression and ignition, is expanded to the cylinder and is released a little above atmospheric pressure with a corresponding temperature of about 400° Fahr. The point of cut-off, while constant for the full and most economical load of the engine, is made earlier by the governor as the load gets lighter, or later as the load gets heavier, giving a notable flexibility for an internal combustion engine.

Owing to the complete expansion of the

The detail view shows a section through the valves of one of the explosion chambers. By removing six nuts, the valve bushing and valves can be removed from the cylinder for regrinding or inspection.

Gas is piped to the chamber, *A*, in the sub-base and air to the chamber, *B*, which pass through the cylinder supports to the chambers *A'* and *B'*, ready to pass into the



VIEW OF TANDEM SARGENT GAS ENGINE.

mixing chamber when the cam depression, *M N*, passes the roller and the ports, *F*, in the piston valve register with the ports *E* and *D* in the bushing. When the piston valve goes down to this position, the confined air in the piston valve dash-pot forces open the poppet valve, thus giving free admission to the charge. When the point *N* of the cam reaches the roller it is forced down, while the other end of the lever goes up, carrying the piston valve which cuts off the admission. The poppet valve seats and both valves re-

cornices, skylights, finials, etc., has adopted a style with large and clear figures. The Detroit Leather Specialty Co., 175 Beecher Ave., Detroit, has had a unique and attractive design specially prepared for its purposes. This last company has also prepared for its friends a little leather pocket matchsafe. The Morris Machine Works, of Baldwinville, N. Y., are distributing a large wall calendar containing an excellent reproduction of Pierce's painting "On Furlough," showing four horses' heads; this calendar is noticeable for the in-

ing all the many types of pumping, condensing and measuring devices developed by the company in its career of 64 years. Duplex pumps of many patterns and sizes, pump accessories, sinking pumps with a new enclosed valve gear, surface and jet condensers and the type designed particularly for steam turbine stations, cooling towers, water-motor pumps, feed-water heaters, water meters, electric house pumps, and the recently developed types of centrifugal pumps are fully described and illustrated.

A NEW MEDAL OF HONOR IN ARCHITECTURE.

At a recent meeting of the New York Chapter of the American Institute of Architects, the following self-explanatory resolution was passed:

Resolved, That the New York Chapter of the American Institute of Architects shall establish a medal of honor for award to designers of buildings represented in the annual exhibitions of the Architectural League of New York, and that the conditions accompanying the proposed award shall be as follows:

First, That any architectural work in the United States, or territory belonging to the United States, if completed within five years previous to the date of exhibit, may be offered for consideration.

Second, The architect or architects who designed such a work, in order to be eligible to the award, must present for exhibition one or more photographs of the executed work, also one or more drawings including a small scale plan, and shall submit to the jury such working drawings of the structure as they may desire to examine.

Third, That an architect or firm of architects to whom this medal may be awarded once shall be ineligible for a future award.

Fourth, That the medal shall be bronze with the following inscription:

Obverse.
Bas-relief.

Reverse.

Awarded by
The New York Chapter
of the American Institute
of Architects to
(name)
for
(name of building)
as a distinguished work
of architecture represented
at the annual exhibition
of the Architectural League
of New York in the
year (1905).

Fifth, That the medal shall be accompanied by a certificate setting forth the name of the completed structure which formed the basis of the award together with the considerations which, in the opinion of the jury, characterized the structure as one worthy of the award.

Sixth, That the jury shall consist of seven architects, one the President of the League, one the President of the Chapter, and five appointed by the Chapter.

Seventh, That one medal only shall be awarded each year and four members of the jury voting for the author or authors of the same work shall be necessary to an award, and that no award shall be made if in the opinion of the jury no work presented is sufficiently meritorious.

Eighth, In case the award is made to two or more joint authors of a work, a copy of the medal shall be struck for each.

The next exhibition of the League, it should be added, will be held at the American Fine Arts Building, 215 West 57th St., from Feb. 12 to March 4.

MILWAUKEE BRANCH OF THE AM. SOC. M. E.

The Milwaukee Branch of the American Society of Mechanical Engineers, instituted some time ago in accordance with a section of the new constitution of the national organization, has recently issued its own constitution and by-laws. Any member of the national society may become a member of the local society, while any person who is connected with engineering work and is not less than 21 years of age may become an associate member. Associate membership in the local society, however, is in no way to be construed as connection with the American Society of Mechanical Engineers. As to fees and dues, the constitution stipulates that "The annual dues of each local member shall be the amount remitted by the general council (as the council of the national organization is designated) from the annual dues paid to the national society. The initiation fee for an associate member of the local society shall be \$5 and the annual dues shall be equal to the amount remitted per member by the national society to the local society." Regular meetings are held the first Wednesday in each month except July and August. Any paper presented by an associate member may, after reading and discussion before the local society and with permission of the member presenting the paper, be submitted by the local council to the general council.

The council of the local society is consti-

tuted as follows: President, M. A. Beck, chief engineer, Pawling & Harnischfeger; Geo. P. Dravo, consulting and contracting engineer of Milwaukee; M. L. Jenkins, assistant superintendent, Allis-Chalmers Co.; S. L. G. Knox, manager and chief engineer, Bucyrus Co.; E. P. Worden, mechanical engineer, Fred M. Prescott Steam Pump Co.; secretary-treasurer, W. G. Starkweather, Allis-Chalmers Co.

THE BUCKEYE TRENCH MACHINE.

The Buckeye Traction Ditcher, made by The Van Buren, Heck & Marvin Co., Findlay, Ohio, is constructed on a strong, rigid frame which carries the boiler and engines (which are of the duplex type on all machines cutting 20-in. trenches or over) and all necessary machinery for the operation of the machine. The excavating wheel is carried on the rear end of the truck which supports the machinery by means of wire cables, and a shoe which slides along in the bottom of the trench, thoroughly leveling the little inequalities which are occasioned by the vibrations of the machine.

The machine is known by the size trench it will cut, the smallest cutting a trench 11½ in. wide by 4½ ft. deep, while the largest that has yet been made cuts a trench 54 in. wide to a depth of 12 ft. Intermediate sizes are made anywhere between the above. One great feature about this machine is that it will cut to a perfect grade at one cut, regardless of the uneven top of the earth. This is done by means of targets and a sight bar, attached to the excavating wheel, so that when the machine passes over the line once

exceeded the expectations of the company, that it has been compelled to double its capacity two different times in less than two years (the short time it has been making machines), and in this time has shipped machines to many foreign countries.

TWO PRESSURES FROM ONE AIR COMPRESSOR.

In many establishments using compressed air it is desirable to have two pressures to cover the full range of the requirements. First, there is the demand for 80 to 100 lb. for pneumatic tools, hoists and general power purposes. Second, there is need of air of only 20 to 25 lb. for sand blasting, painting, blowing chips from work, and general uses demanding a low pressure.

The usual plan heretofore pursued is to compress all the air to the highest pressure and then by means of a reducing valve, throttle down such amount as is needed by the low pressure system. Such a course is very wasteful, for the power required to raise the pressure from 25 to 100 lb. is entirely lost for so much of the air as is used in the low pressure system. This loss is so great that in some establishments using any considerable amount of air two entirely separate compressors are employed, one for each system.

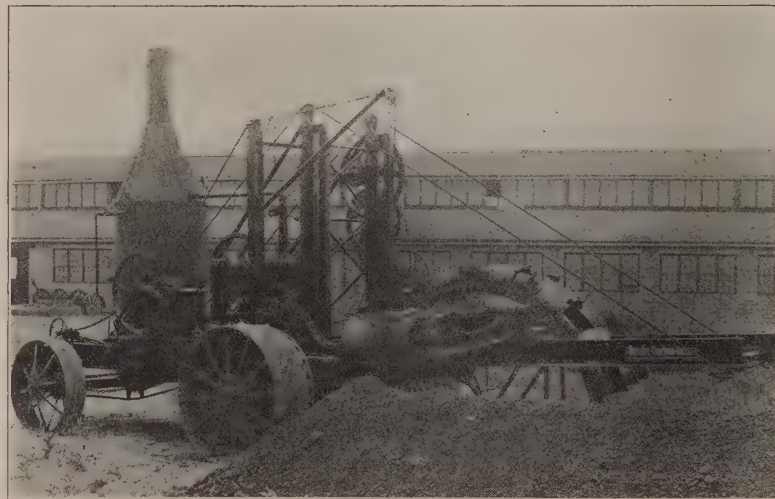
Modern compressors for 100 lb. pressure are invariably made on the compound system. The low pressure cylinder furnishes air to the intercooler usually at about 25 lb. pressure, but, for any good reason, this pressure can be changed by proper proportions of the cylinders.

meantime the speed and pressure governors of the machine will regulate the speed of the machine, making it run to suit the demands of both systems.

With these arrangements on the Norwalk compound compressor any quantity of air within the limit of the machine can be drawn off at any time and speed will be automatically adjusted. The air can be drawn out at two pressures as desired, all at the high pressure, or all at the low pressure, or any proportion at high or at low at the same time. The operation of the compressor is entirely automatic, delivering the air at the pressure desired and in the quantities as used.

THE SUMMERS DUMP CAR.

For several months experiments have been made at some of the works of the Carnegie Steel Co. and on the Pennsylvania and Baltimore & Ohio lines, with a self-dumping hopper-bottom car built by E. W. Summers, of Pittsburg. It is so constructed that its load can be dumped on the center of the track, on either side, or on both sides simultaneously. This is done by constructing the bottom of the hopper of two large doors, one forming each slope of the bottom; the fixed ends of the hopper are sloped so that their lower parts clear the trucks. Each door is supported at its four corners by heavy chains. The two inner chains at each end, one on each door, are wound on a shaft reaching into the car from the side, and these two shafts can be turned simultaneously by gears and a shaft outside the hopper in a well-protected space on the side of the body. The chains at the two outer corners of each door pass over



VIEWS OF THE BUCKEYE TRENCH MACHINE AND A TRENCH SEVEN FEET DEEP CUT BY IT.

the trench is ready for the pipe or tile, as the case may be.

The excavating wheel is without a hub, the power being applied to each side of the rim by means of steel gears and exerted exactly above the earth that is being cut. This wheel is made of steel rims and a series of buckets placed on them, armored with tool steel knives and rooters which enable it to cut any material that can be picked with a hand pick.

The wheel cuts from the bottom of the trench up, and as there is no bottom in the bucket the earth is kept in them by means of an arc, which is held firmly to its place, forming a bottom in the buckets until it reaches a certain point when it is discharged on an endless conveyor, the frame of which is made of steel and covered with a special belt prepared for the purpose. The earth is deposited with a narrow or wide berm as may be desired.

While the traction power is similar to that of an ordinary traction engine, it is necessarily made heavier to stand the strain of the machine.

The company guarantees these machines to cut 3 ft. of trench per minute at a depth of 3 ft. In ordinary cutting, but there are many statements in the company's office which far exceed this guarantee. A few are as follows: 2,050 ft., 5 ft. deep in 10 hours; one mile 40 in. wide, 65 in. deep, in 30 consecutive hours; 100 ft. per hour at a depth of 8 ft.; 415 ft. in 5 hours at a depth of 11 ft., and 175 rods of tilling trench in 10 hours, besides many other similar ones.

The demand for these machines has so far

In the ordinary compound compressors the low pressure air in the intercooler is not available for use, for the reason that whenever air is drawn from the intercooler the pressure immediately falls. The low pressure—or first air cylinder—is forcing air into the intercooler, but the high pressure—or second cylinder—is constantly taking it out, and if the pressure is to be kept up when air is drawn out for external use, then the second cylinder must be shut off or cease working to the exact extent that air is removed from the intercooler. It will not answer to shut off the supply to the second cylinder by throttling its intake, for in that case the little air remaining in the inlet ports of this second cylinder falls to a very low pressure and finally approaches vacuum. From this low pressure for a few revolutions the air is compressed to the high pressure of the final discharge. This brings about a very great degree of compression, with corresponding development of great heat. The skip valve now introduced by The Norwalk Iron Works Co., of South Norwalk, Conn., is a most complete and satisfactory solution of the problem. These valves are used as the inlet valves of the second cylinder. The arrangement is such that if the pressure in the intercooler falls below a certain predetermined point, then these skip valves will remain open and thereby the second cylinder rejects its supply of air, throwing it back into the intercooler. Thus provision is made for the outside draught. The skip valve automatically adjusts the amount, remaining open any number of revolutions or only a part of one revolution, as circumstances may require. In the

sheaves to another shaft on the side of the body. There are thus three operating shafts by which the dumping is controlled.

The shafts are operated by worm gearing on a platform at one end of the car, and by opening the doors different amounts the manner in which the load is distributed can be regulated. The hopper can be discharged from a moving car as easily as from one that is standing, and the operation occupies less than a minute, although more than that time is needed to close the doors.

The construction of the hopper makes it impossible to use center sills, and the lower parts of the sides have accordingly been designed to act as girders, which are connected by deep transverse beams.

The cars have been tested with coal, ashes, pig iron, crushed rock, slag and gravel. They are made wholly of steel, and have a capacity of 40 cu. yd., equivalent to a rating of 100,000 lb. They are 31½ ft. long, 9½ ft. high, and weigh about 19 tons.

The E. W. Bliss Co., Brooklyn, N. Y., has issued two new catalogues of power presses. One is devoted exclusively to the straight-side "Bliss" press, of which 23 types are illustrated. These were designed specially for trimming drop forgings, but are also used for punching and stamping heavy blanks for electric apparatus, sewing machines, typewriters and other parts of machinery. The second catalogue relates to "Stiles" presses for heavy punching and stamping. A Spanish edition of its catalogues has been prepared recently, and also a new edition of its pocket book of useful data relating to sheet metal.

EST OF STIRLING BOILER AT MAIDEN CREEK PUMPING STATION, READING WATER WORKS.

The boiler plant at the Maiden Creek pumping station of the Reading Water Works consists of four Class A No. 12 Stirling boilers rated at 175 h.p. each, fitted with the latest type Wilkinson stokers. Each boiler contains total heating service of 1,739 sq. ft., and the ratio of heating surface to grate surface is 8.3 to 1.

The contract for this plant stipulated that the boilers should be capable of delivering 4,000 lbs. of dry, saturated steam per hour under a working pressure of 155 lbs. per sq. in. by gauge from feed water at 150 deg. Fahr., using the best regular bituminous coal commercially available in the city of Reading; and under these conditions should evaporate 9 lbs. of water per pound of dry coal, the uptake temperatures not to exceed 475 deg. meanwhile.

It was further stipulated that the moisture in the steam should not exceed one and one-half per cent. (1½ per cent.), and a premium or bonus of two hundred and fifty (\$250.00) dollars would be paid the boiler contractor by the Water Works Board for each pound increase in evaporation over the 9 lbs. specified in the contract.

The above 5,000 lbs. evaporation per hour under the conditions of pressure and feed stated is equivalent to 5,370 lbs. of steam per hour from and at 212 deg., which, in accordance with the rating of the American Society of Mechanical Engineers, is further equivalent to 162 boiler horse-power.

The equivalent evaporation from and at 212 deg. corresponding to 9 lbs. under the actual conditions stated, is 10.03 lbs.

The final and official test on the boilers took place Tuesday, September 20, 1904, and was conducted by Mr. Charles A. Hague, Consulting Engineer of the Board, with offices in New York. Mr. Hague was assisted by Mr. E. L. Neubling, Superintendent and Engineer of the Water Works Department. Every precaution was taken to obtain actual results and all data were carefully recorded. The water evaporated was measured in two measuring barrels marked No. 1 and No. 2 which discharged into a tank from which the feed pump delivered the water directly into the boiler. The coal used was ordinary Pocahontas, purchased in the open market, and was carefully weighed in lots of 200 lbs. each, and delivered upon the firing room floor, whence it was shoveled directly into the hoppers of the mechanical stokers. Independent tallies of water and coal were kept so that a check could be made. The moisture in the steam was determined by a Carpenter throttling calorimeter, the temperature readings of the thermometer being taken every half hour. The feed and uptake temperatures were taken with mercurial thermometers. A small portion of coal was taken from each wheelbarrow load, and from the sample thus obtained the moisture was determined by weighing and drying in the usual manner.

The analysis of the coal was made by Messrs. Ricketts & Banks, of 104 John St., New York City.

The following is the complete report:

Kind of fuel....Pocahontas coal, run of mine	
Kind of furnace.....Wilkinson stoker	
Date of trial.....September 17, 1904	
Duration of trial.....10 hours	
Grate surface, sq. ft. 36	
Water heating surface, sq. ft. 1,739	
Ratio of water heating surface to grate surface, ...	48.3 to 1
Steam pressure by gauge, lb. per sq.in. 135.4	
Force of draft in furnace, ins. of water. . .	.24
Force of draft in rear pass of boiler, in. of water	.30
Force of draft in stack, in. of water.	.35
Temperature of steam, degs.	358.4
“ of feed water entering boiler, ...	.68
“ of escaping gases from boiler, degs.	.418
Weight of coal as fired, lbs.	5,490
Percentage of moisture in coal, per cent.	.5
Total weight of dry coal consumed, lbs.	5,643
Total ash and refuse, lbs.	204
Total combustible consumed, lbs.	5,439
Percentage of ash and refuse in dry coal, per cent.	3.4
Proximate analyses of dry coal:	
Fixed carbon, per cent.	72.17
Volatile matter, per cent.	18.93
Moisture, per cent.	.34

Ash, per cent.	8.56
Calorific value by calorimeter, per lb. of dry coal, B.t.u.	14,430
Coal consumed per hour, lb.	594
Combustible consumed per hour, lb.	543
Coal per sq. ft. of grate surface per hour, lb.	16.5
Combustible per sq. ft. of grate surface per hour, lb.	15.1
Percentage of moisture in steam, per cent.	.75
Quality of steam, per cent.	99.25
Total weight of water feed to boiler, lb.	56,330
Water actual evaporated, corrected for quality of steam	55,908
Factor of evaporation, lb.	1.1958
Equivalent water evaporated into dry steam from and at 212°, lb.	66,910
Water evaporated per hour, lb.	5,633
Water evaporated per hour, corrected for quality of steam, lb.	5,591
Equivalent evaporation per hour from and at 212°	6,691
Water evaporated per hour per sq. ft. of grate surface, lb.	155.3
Equivalent evaporation per hour from and at 212° per sq. ft. of grate surface, lb.	185.8
Water evaporated per hour per sq. ft. of water heating surface, lb.	3.21
Equivalent evaporation per hour from and at 212° per sq. ft. of water heating surface, lb.	3.85
Horse-power developed (¾ lb. of water evaporated per hour into dry steam from and at 212°, equals 1 h.p.), h. p.	194.0
Builders' rated h. p.	175.0
Percentage of h. p. developed above builders' rating	10.8
Water apparently evaporated under actual conditions per lb. of dry coal.	9.90
Equivalent evaporation from and at 212° per lb. of dry coal, lbs.	11.85
Water apparently evaporated under actual conditions per lb. of combustible, lb.	10.279
Equivalent evaporation from and at 212° per lb. of combustible, lb.	12.30
Efficiency of the boiler, including the grate; heat absorbed by the boiler, per lb. of dry coal, divided by the heat value of 1 lb. of dry coal, per cent.	79.33

The foregoing results show that the performance of the boiler was most creditable. The efficiency of the boiler, 79.33 per cent. is remarkably good, particularly when it is considered that the coal contained as much as 8.58 per cent. of ash, and on the day of the test 5 per cent. of moisture. The amount of ash as calculated from the ash and refuse in the ash-pit, is much less than the amount given in Messrs. Ricketts & Banks' analysis, which would indicate that all of the ash made during the test was not weighed back. Had this been done the equivalent evaporation per pound of combustible would have been even higher than 12.3 lbs., which figure, however, with coal containing 14,400 B.t.u., is exceptionally good. The moisture in the steam is three-quarters of 1 per cent., or only one-half of the maximum allowable amount stipulated in the contract. The uptake temperatures averaged only 418 degrees—57 degrees lower than the limit set by the specifications.

The official test shows that the evaporation from and at 212 degrees per pound of coal exceeded the contract requirements by 1.85 pounds, and the boiler contractor thus obtains a substantial bonus. The test was satisfactory to Mr. Hague, the Water Works Board, and all concerned.

TRADE PUBLICATIONS.

The General Fireproofing Co., Youngstown, O., has published a well-illustrated catalogue of metal office furniture, a specialty added to its older lines of expanded metal lath and flooring, fireproof doors, windows and steel trim. The pamphlet describes steel shelving, document files and drawers, letter files, plan cases, map tube drawers, library stacks, flat and roll-top desks, wardrobe lockers and counters.

The Bucyrus Co., South Milwaukee, Wis., has published three books which will appeal strongly to railway officials and contractors. The first describes railroad wrecking cranes and pile drivers. It gives prominence to the 100-ton crane described in this journal not long ago, and also to a 70-ton crane built for the Southern Railway. The pile driver is an all-steel machine with a platform rotating

through 360 deg., and can propel itself if necessary. The second catalogue is a description of steam shovels. One of these is shown at work on a sewer trench, which it straddles. Illustrations are given of 35, 45, 55, 65, 70, 85, and 95-ton shovels, and letters from users of them give data concerning the capacity with different materials. The dipper teeth have renewable points of manganese steel. The third catalogue describes placer dredges, of which the company has built 25 in the last 3 years. Their construction is explained in detail. They are ladder dredges fitted with steam equipment or electric motors and represent the latest ideas in plant of their type. All three catalogues contain many excellent illustrations.

Electric-driven centrifugal pumps for house-tank service are described in a pamphlet from the Prindle Pump & Engineering Co., 95 Liberty St., New York. They are made in three sizes, and with 110, 220 or 500-volt direct-current motors, 60-cycle, 110-volt, single-phase motors, or 110 or 220-volt, 60-cycle two or three-phase motors. The action of the motor is controlled by an automatic tank switch, described in the pamphlet.

In foundry practice, particularly with heavy and intricate castings, it is important to take all reasonable precautions against loss from defective castings. One source of such loss is found in poor chaplets, and after considerable experiment the McCoy & Lukens chaplet has been devised to remedy defects in such articles. These are fully described in a pamphlet from W. W. Lindsay & Co., Harrison Bldg., Philadelphia.

An extensive line of air compressors and vacuum pumps is described in a pamphlet just issued by the Clayton Air Compressor Works, 114 Liberty St., New York City. The machines include single and duplex machines, steam-driven, power-driven and electrically-driven by gear, chain and belt. The last page also shows air compressors driven by direct-connected oil engines, forming small convenient units for quarries, stone shops, small machine shops and all small plants where air is used for general purposes, such as cleaning, etc. The air lift, the uses of compressed air in car barns, and vacuum machines for experimental work, are also described. The range of sizes includes machines displacing from 2 to 1,400 cu. ft. of free air per minute.

Those interested in municipal improvements will find one branch of the subject handled in an entertaining manner in a recent catalogue of the J. L. Mott Iron Works, 84 Beekman St., New York, the particular phase in question being the public comfort station and the public bath, and the presentation consisting in a large measure in the reproduction of photographs of several such stations in both New York and Brooklyn. While the treatment of the subject is to direct attention to the sanitary appliances and ventilation employed, the views are both interior and exterior and the descriptions are accompanied by plans. The latter half of the thirty pages constitutes a detailed illustrated catalogue of plumbing goods for such purposes.

The Ingersoll-Sergeant Drill Co., 26 Cortlandt St., New York, has issued the advance sheets of catalogue 36, consisting of a book of 72 pages. They comprise engravings of the various classes of air compressors together with the usual full tables of dimensions and capacities. A number of half-tone engravings of notable installations are given, but the publication is of the permanent character that attaches to a compilation of machine dimensions and the like, to which frequent reference must be had.

One of the most pleasing books issued in celebration of the opening of the New York subway is that of the Ingersoll-Sergeant Drill Co., of that city. This company supplied 16 air compressors and 194 rock drills to the contractors for this work, and has furnished the Interborough Rapid Transit Co. with the ticket-choppers and air compressors used in the operation of the railway. The pamphlet gives a clear account of the most important features of the road.

The Wile Power Gas Co., 212 Cuffler Bldg., Rochester, N. Y., has published Section 1 of its catalogue A on producer gas and catalogue B on gas producers. In the latter the three types of producer built by the company are described: An automatic producer, which is a combination of the suction and pressure types fitted with a patent regulator,

the producer itself being under suction, while the gas is supplied under pressure; a suction producer, built for power only; and a water-bottom gas producer, designed for soft or hard coal and suited for making gas for fuel. The types are described and illustrated at length. The section of catalogue A is largely an interesting discussion of the uses and cost of producer gas.

The William B. Pollock Co., Youngstown, Ohio, has issued a handsome album of views of blast furnaces it has erected during the last five years, and also of some of its specialties like cinder and hot metal cars, steel mixers and steel chimneys. For reasons that will be appreciated by those familiar with the iron industry, no name of the plants illustrated are given, but this omission will not detract from the value of the book as a pictorial explanation of the best practice in blast furnace design in this country at the present time. The few illustrations of steel chimneys and standpipes in the book do not give a fair impression of this part of the company's business.

The clam-shell dredging bucket is too well known among contractors to require much description, but a modification of it, by which the opening and closing is done by a pneumatic device, is an interesting novelty. This pneumatic bucket was brought out about four years ago, and the experience gained in its use since then has enabled the inventor to improve some of its details. A description of it is given in a pamphlet published by W. H. Arnold & Co., 165 Prospect Park West, Brooklyn.

A special steam-head for operating deep-well pumps is described in Bulletin L-602, published by the Laidlaw-Dunn-Gordon Co., of New York City. This device is designed for pumping from all classes of wells where it is necessary to place the pump cylinder far below the steam cylinder.

The Norman W. Henley Publishing Co., 132 Nassau St., New York, has issued a catalogue of books written particularly for mechanics, engine attendants and others, without technical school training, who desire to acquire a general knowledge of the scientific basis on which the design of tools, boilers, steam and gas engines and the like depends, and of the best practice in using such tools and power plants.

Among the recent publications of the General Electric Co., Schenectady, N. Y., may be mentioned the following: Flyers; No. 2143, the Nobiac heat-resisting enclosing globe, of a special glass without lead in its composition but highly refractory, tough and free from chemical change when heated; No. 2144, pillow blocks for shafts 1½ to 15 in. diameter and 4½ to 45 in. in length; No. 2145, standard cast-iron flange couplings for shafts 1 to 8½ in. diameter. Bulletins; No. 4386, attachments for type C, forms M and K, circuit breakers; No. 4387, continuous current railway switchboards; No. 4388, curve-drawing voltmeters, wattmeters and ammeters for alternating current circuits; No. 4389, modern long-distance electrical transmissions; No. 4390, electric railway locomotives, containing a large amount of valuable information on the characteristic features of a number of such locomotives employed in heavy railway work; No. 4391, air-blast transformers.

The Hornsby-Akroyd oil engine is well known on account of its wide introduction for small isolated electric plants, but it has also been employed in a number of situations where its use of crude oil or kerosene possesses special advantages, as in portable air compressing plants for use with pneumatic tools, in portable pumping plants for draining cellars and trenches, for which purpose the New York Sewer Department has a very interesting outfit, and in small water-works pumping stations. A description of a number of such plants, as well as an account of the more common use of the engine in electric lighting service, is given in a pamphlet issued by the De La Vergne Refrigerating Machine Co., New York.

The Star Brass Works, 162 East Lake St., Chicago, Ill., has published a useful pamphlet describing the Star machines for spraying whitewash and cold-water paints. Machine whitewashing and painting has so long passed its experimental stage that the chief interest in such work at the present time relates to the apparatus employed. This pamphlet describes a large number of styles and gives sound advice concerning the materials to be used in such work and the methods of preparing them. The few failures of good spray-

ing apparatus that have come to the knowledge of this journal have been due to improper preparation of the materials for spraying and, in one case, to the use of the machine for an oil plant, for which it is not adapted. For this reason the practical hints on machine whitewashing and painting in this pamphlet deserve special attention.

The McLennan Paint Co., Buffalo, N. Y., has issued an unusually interesting pamphlet on structural steel paints. It refers entirely to those having linseed oil as a vehicle, and explains the action of the oil and the pigment when exposed to the weather in a thin film. The properties of different pigments are discussed and the purposes of the improvements in linseed oil which the company has introduced are explained. The pamphlet closes with an account of tests of a number of different classes of paints.

The usefulness of narrow gauge railways in milling, mining, building, contracting, lumbering, agriculture and other industrial enterprises, is the subject of an interesting pamphlet by Mr. Ernst Wiener, entitled "On the Track." It is a general discussion of the importance of the narrow gauge railway in modern industries, and is supplemented by a brief description of the equipment furnished by the author's firm, Arthur Koppel, 66 Broad St., New York.

A concise and comprehensive catalogue of feed-water heaters has been issued by the John H. McGowan Co., Cincinnati. It first explains the open type, in which the exhaust steam rises from the bottom of the vertical shell while the feed water passes downward through a series of trays, on which scale-forming matter in the water is precipitated. The second part describes the closed heater, while the final part is devoted to exhaust heads and back-pressure valves.

The Ransome Concrete Machinery Co., 11 Broadway, New York, has issued a small pamphlet describing the features of its 1904 concrete mixer and also a new mixer, called the 1905 model, which has been brought out for use on widely separated contracts. The machine is readily knocked down and set up, and can be packed compactly for shipment. All parts except four castings can be repaired if necessary by a blacksmith. The 1904 mixer has been making some remarkable records this year, turning out 35 batches an hour when fed by wheelbarrows and 100 batches when fed from overhead bins. One machine mixed 15,000 cu. yd. without requiring repairs.

Rope transmission in cement mills is the leading subject explained in a large book of 76 pages from the Dodge Manufacturing Co., Mishawaka, Ind. The introductory chapter describing the materials and processes of the industry was written by Prof. S. B. Newberry for this journal. This is followed by a general statement of the power equipment needed in a thousand-barrel plant, after which the power transmission systems of the mills of the following companies are explained: Brier Hill Iron & Coal Co., Marquette Cement Mfg. Co., Catskill Cement Co., Wolverine Portland Cement Co., Utica Cement Mfg. Co., Newaygo Portland Cement Co., Iola Portland Cement Co., Egyptian Portland Cement Co., Great Northern Portland Cement Co., Bronson Portland Cement Co., Southern Cement Co., Sandusky Portland Cement Co., Elk Portland Cement & Lime Co., and Kansas Portland Cement Co.

The American Bridge Co., of New York, has issued a very convenient memorandum book and diary for holiday distribution. It has 3x5-in. pages, ruled for a diary and contains a calendar, tables of principal weights and measures, census, postage and other general data, maps of the United States and possessions, and condensed tables of steel bars and shapes.

The Belgian cement trade has to deplore the almost total loss of the American market, according to Vice-Consul Haine at Antwerp. The United States was formerly one of the best customers of Belgian manufacturers, but within the last two or three years has practically emancipated itself from European manufacturers, and produces a surplus, which it is expected will be offered on European markets. This has caused a serious depression here, where prices reached in 1903 their very lowest limit. Many factories have been transformed both as to machinery and methods in order to meet the depression.

The Deane Steam Pump Co., of Holyoke, Mass., is distributing a new catalogue on condensers. This publication reviews the principles and advantages of the several types

of condensers as applied to steam engines, including surface and jet condensers, and discusses, also, vacuum pumps, exhausters, air and circulating pumps, and other auxiliaries. A recent development, which is treated of quite fully, is the provision of proper condensing arrangements for steam turbines. Unlike the reciprocating engine, the turbine can expand its steam to the extreme limit of the exhaust pressure and every inch of vacuum about 26 in. increases the economy by from three to five per cent. It is therefore advantageous to use the most perfect type of condensing equipment for this service, which has led to the production of improved types of independent air and hot well pumps, separate circulating pumps, air coolers, etc.

THE IRON TRADE SITUATION.

The condition of the iron and steel industry at the beginning of the year is summed up in "Iron Age" of this week, as follows:

Interest centers in the steel rail trade, in which there is a shade of disappointment from the standpoint of the mills. The railroads have not come forward quite as liberally with their orders as was expected, intimating some dissatisfaction with the reaffirming of the 1904 price for 1905. During the past week the Vanderbilt lines placed a total tonnage of 90,000 tons, which is below the estimates and will probably be added to later on. The Cincinnati, Hamilton & Dayton road has ordered 10,000 tons, which may be increased to 15,000 tons. The Reading system has placed about 15,000 tons. It turns out that the requirements of the Southern Railway were very much larger than was thought at first. The total amount placed was about 120,000 tons, of which the Tennessee Company was allotted 66,000 tons, the latter concern took 15,000 tons for another road two weeks since, and with the older Louisville & Nashville and Gould system orders is filled up for practically the whole of the current year.

It is worthy of note that leading sellers of light rails now ask \$25 for the first half of this year and \$27 for the second six months.

The continued buying of the railroads is observed in rolling stock. Some large orders for steel cars have been given out and negotiations for additional lots are pending. This has led to greater activity for the plate and structural mills.

What may be a very large transaction is the contract for the bridge work for the Harriman lines. This calls for a minimum of 15,000 tons, but it may be expanded to a maximum of 25,000 to 30,000 tons, the work going to the American Bridge Company. Some good work is coming up in other quarters. Our Chicago correspondent estimates that structures in the dry goods district in that city will require about 25,000 tons. It is noted, however, that sharp competition has again developed on fabrication of structural material, and that the bridge shops are quoting prices which seem inexplicable in view of the official figures for the shapes made by the rolling mills.

There has been a good deal of activity in the pipe trade, which is reflected in the skelp market. The mills, under the leadership of the National Tube Company, have advanced prices on merchant pipe by lowering discounts half a point, and have promulgated a readjustment of discounts on boiler tubes.

There has been little doing in pig iron. Buffalo makers, who have been heavy sellers lately, that being the cheapest market, have advanced prices to and somewhat beyond the parity of other districts. The furnaces connected with the steel works have during the holidays accumulated a little iron, the furnaces remaining in operation while the steel plants were idle.

The European steel makers, and notably the Germans, have again advanced prices on steel, while the rolling mills are asking higher prices on shapes and bars.

PERSONAL NOTES.

Mr. Thomas W. Jones has been appointed surveyor of Boone county, Ark.

Mr. H. G. Ludlow, inventor of the Ludlow valve, died recently at Troy, N. Y.

Mr. Emmett Smith, city surveyor of Bayonne, N. J., has tendered his resignation to the city council.

Mr. Russell Robb has become a partner in the firm of Stone & Webster, consulting electrical engineers, Boston, Mass.

Mr. J. W. Kendrick, city engineer of Birmingham, Ala., has been elected president of the Engineering Association of the South.

The office of the U. S. Geological Survey district hydrographer for New England has been removed to 6 Beacon St., Boston, Mass.

Mr. G. W. Dalgorn, of Natchez, Miss., has accepted a position with the Monroe & Southwestern R. R., under Capt. Polk, chief engineer.

Mr. Edward D. G. Jones, who died on Dec. 30 at Pittsfield, Mass., was one of the pioneer manufacturers of paper mill machinery in the United States.

Mr. Louis G. Destremps, of Fall River, Mass., has taken his son into partnership under the firm name of Louis G. Destremps & Son, architects, Bennett Bldg., Fall River, Mass.

Mr. Chas. Wanzer has been appointed city engineer of Portland, Ore., by the mayor, to fill the office during the remaining six months of the term of Mr. W. C. Elliott, who has resigned.

Messrs. Robert Maynicke and Julius Franke have formed a partnership under the firm name of Maynicke & Franke, and will continue as practising architects at 293 Fifth Ave., New York City.

Mr. Daniel Ashworth, the well-known Pittsburg mechanical engineer and steam specialist, has retired from business affairs to devote his attention to engineering work. His office is in the Park Bldg. in that city.

Walter G. Kirkpatrick has resigned as city engineer of Jackson, Miss., after seven years' tenure, to engage in private practice, under the firm name of Kirkpatrick & Johnson, civil and mechanical engineers, Jackson, Miss.

Mr. E. S. von Piontkowski has resigned his position as resident engineer on the Mexican Central R. R. to take the appointment of chief engineer for the United Railways of Yucatan, with headquarters in the city of Merida.

Mr. J. W. Thompson has been appointed general manager of The Southern Indiana Railway Co., with offices at Terre Haute, Ind. The office of general superintendent, heretofore held by Mr. Thompson, has been abolished.

The firm of Edwin H. Ludeman & Co. has succeeded Edwin H. Ludeman, 39-31 Cortland St., New York City, as agents for Robert Wetherill & Co., the Williams engine, the Fitchburg Steam Engine Co., Houston, Stanwood & Gamble Co., and various boilers.

Mr. William Hazard has been made general superintendent of the Windell-Finley Co., of Chicago, Ill. This company was recently incorporated to do a general bridge contracting and engineering business and to operate extensive stone quarries at Mankato, Minn.

The Board of Estimate of New York City has appointed Mr. Nelson P. Lewis, chief engineer of the board; Prof. George G. Seaver, of Columbia University, and Dr. Cary T. Hutchinson, as a commission to draw general plans and specifications for a municipal lighting plant.

Mr. C. W. Kelly, superintendent of bridges and buildings on the Iowa Division of the Chicago & Northwestern R. R., has resigned to accept a position with Fairbanks, Morse & Co., Chicago, Ill. Mr. Kelly will travel for that company in the interest of its railway supply department.

Mr. Wm. Barclay Parsons has been retained as consulting engineer of the New York, Westchester & Boston Ry., and Mr. Wm. A. Pratt has been engaged as chief engineer, with offices at 30 Broad St., New York. Mr. John Bogart will retain his connection with the company in a consulting capacity.

Mr. R. E. Peary, civil engineer, U. S. N., recently sent a letter to the New York "Tribune" stating that the new ship of the Peary Arctic Club will be completed in about two months. In order to organize the next polar expedition thoroughly the club will need additional subscriptions to the amount of \$100,000. Small as well as large contributions are gladly received.

Mr. E. S. Lea has resigned his position as sales manager for the De Laval Steam Turbine Co., and has opened an office at 42 Broadway, New York, as consulting engineer. Prior to his four years' connection with the De Laval company, his experience lay in the designing and construction of power plants and water works, and in the manufacture of general machinery.

Mr. Harrison Stidman has been appointed superintendent of street cleaning in the District of Columbia. Mr. Stidman graduated

from Cornell University in 1891, with a degree of civil engineer. From 1893 to 1895 he was connected with Col. George E. Walling, Jr., and during the latter part of the time was assistant general superintendent of the street cleaning department of New York City.

Mr. Walter S. Timmis, consulting engineer for the Sackett & Wilhelms Lithographing Printing Co., Brooklyn, N. Y., and design of the company's present plant, which was described in The Engineering Record of Feb. 6 and 13, 1904, has opened an office at Nassau St., New York, to engage in consulting work, especially for the printing and paper industry, and in buildings, power and lighting plants.

Mr. John W. Lieb, Jr., president of the American Institute of Electrical Engineers, has been made a Commendatore of the Order of the Crown of Italy. He established the Edison system at Milan about a score years ago and has ever since kept up the friendships formed during his residence in Italy. During the last summer he was member of the local committee of the Italian Electrical Association and its delegates received many courtesies at his hands during their visit to the United States.

Mr. W. S. Montgomery, who was for many years sales manager for the Conover Condenser Co., and for the past year New York manager for the Payne Engine Co., has severed his connection with the latter concern and formed a partnership with G. M. Rogers under the firm name of Rogers & Montgomery, with offices at 147 West 23d St., New York City. The new firm will deal in a general line of small labor saving tools, and hardware specialties, and are the exclusive United States sales agents for the new line of patented hand and press punches lately brought out by the Gem Tool Works, of Brooklyn, N. Y.

Campbell Scott has resigned his position of secretary and general manager of the C. & C. Electric Co., New York, to take effect Jan. 1. He has been prominently identified with the C. & C. Co. for some seven years, acting formerly as general sales manager, and for the last five years as secretary and general manager, during which time the company has taken a prominent position in the electrical machinery field. Mr. Scott has been contemplating this action for some time past, but has deferred it until he had seen the completion and successful launching of their new line of Type "S" dynamos and motors. He has not yet announced his reason for his retirement or his plans for the future, but it is reported that he is going into business on his own account.

The department of mechanical engineering of the Brooklyn Polytechnic Institute, like that of electrical engineering, is extending its work by lectures by eminent specialists. Mr. Wm. J. Baldwin, consulting professor of thermal engineering, will give lectures on heating and ventilation; Mr. Reginald Peckham Bolton, consulting professor of mechanical installations, will lecture on the mechanical equipment of office buildings; Mr. Walter B. Snow, consulting professor of aerodynamics, will lecture on blowers and mechanical draft; Mr. H. H. Stock, consulting professor of commercial fuels, will lecture on the mechanical preparation of bituminous and anthracite coal; Mr. Gardner T. Voorhees, consulting professor of cold storage and refrigeration, will lecture on those subjects.

The Pennsylvania Railroad Co. has created the office of assistant chief engineer and appointed Mr. L. H. Barker to it. He was born in 1852, and entered the Pennsylvania service in 1876 as assistant supervisor of the Northern Central line, and later received similar position on the Baltimore & Potomac line. In 1878 he was promoted to the grade of supervisor, and gradually advanced through the various ranks in the Pennsylvania's engineering corps to the position of principal assistant engineer, with headquarters at Jersey City. He assumed the duties of his new office at Philadelphia on Jan. 1. The company has also promoted Mr. Edward B. Temple to the position of assistant to the chief engineer, which has been vacant since the death of W. A. Pratt. Mr. Temple has been with the Pennsylvania R. R. since his graduation from Swarthmore College in 1889.

John P. K. Otis, well-known among water works superintendents, died at his home, Worcester, Mass., on Dec. 31, in his 52d year. He was born in Worcester, in 1853, and obtained his education at the public school in that city and then began the study of engineering, which became his life's work.

He entered the city engineer's office in reester and later attended a course at the reester Polytechnic Institute, from which was graduated in 1873. Mr. Otis was appointed assistant engineer for the construction of the Springfield, Mass., water-works and after two years there, was, in '85, appointed engineer for the construction of the Portland, Me., water-works, a position held until 1878. From 1878 to 1881 he is instructor in civil engineering at the reester Polytechnic Institute. In 1880 became manager of the Union Water Meter Co., of Worcester, and in 1900 was also made president. He had an unusually thorough knowledge of the troublesome engineering problems which arise in the management of water plants and his advice was frequently sought by superintendents.

The resignation of Mr. William Pierson from the office of Deputy State Engineer, of New York, is announced, to take effect on Feb. 1, 1905. Mr. Judson (as the Deputy during the three terms of Ex-State Engineer Bond) has for the last six years, in addition to his other many official duties, had the general charge of the system of highway construction by State aid and has had general supervision of the work, making the local inspections and the acceptances of all of the seven million dollars worth of roads built in New York State, he being recognised as an authority on the subject. He resigns now, at the beginning of a new term, because of the great increase of work which will be entailed by the provisions of the new law for highway maintenance, which puts the care of all the roads of the State, both new and old, under the state engineer, and will so increase the already arduous duties of the deputy as to require that officer to spend practically all of his time in traveling by night and in going over roads by day. This increase of duties would prevent Mr. Judson from giving any attention whatever to his considerable private interests, which are such that he decides to retire from the office of which the added duties will be more than he cares to undertake.

The following candidates for admission to the American Society of Civil Engineers were elected Jan. 4: As Members—John W. Barnett, City Engineer, Athens, Ga.; Ernest W. Larke, Res. Engr., Water Works and Sewers, Colon, for Isthmian Canal Com.; Cloud C. Conkling, Chf. Civ. Engr., Lackawanna Steel Co., Buffalo, N. Y.; William Easby, Jr., Asst. Prof. of Civ. Engr., Univ. of Pennsylvania, Philadelphia, Pa.; Jacob M. Floesch, Chf. Engr., Buffalo, Rochester & Pittsburg Ry. Co., Rochester, N. Y.; Porter D. Ford, Cons. and Constr. Engr., Richmond Hill, N. Y.; James C. Hallsted, member of firm, Robert W. Hunt & Co., New York City; John A. Knighton, Asst. Engr., Bridge Dept., New York City; Jacob S. Langthorn, Engr. in charge, Boroughs of Brooklyn and Richmond, Dept. of Bridges, New York City; David S. Merritt, Engr. and Supt., Water Dept., Tarrytown, N. Y.; Emil Newman, Asst. Engr., Pacific Light & Power Co., Los Angeles, Cal.; Franklin A. Snow, Gen. Contr., Boston, Mass. As Associates—Howard E. Boardman, Chief of Party, North River Div., Pennsylvania, New York & Long Island R. R., New York City; Frank H. Carter, Waterville, Me.; Harry O. Cole, Asst. Bridge Engr., Western Maryland R. R. Co., New York City; Herman Conrow, Asst. Engr., Dept. of Docks and Ferries, New York City; James H. Crosett, Asst. Engr., Constr. Dept., Southern Pacific R. R. Co., San Francisco, Cal.; John W. Doty, with the Foundation Co., New York City; Willard F. Graves, Asst. Engr., South Side Elevated Ry., Chicago, Ill.; Granberry Jackson, Prof. of Drawing, Surveying and Municipal Engineering, Vanderbilt Univ., also in general engineering practice, Nashville, Tenn.; Warren B. Keim, Asst. Engr., Bridge and Constr. Dept., Pennsylvania Steel Co., Harrisburg, Pa.; James L. Lytel, Office Engr., Uncompahgre Valley Project, U. S. Reclamation Service, Montrose, Colo.; Robert H. McPherson, Mech. Engr., Robins Conveying Belt Co., New York City; Chester J. Myers, Asst. Engr., Water Dept., Atlantic City, N. J.; Luther S. Oakes, Asst. Engr., Constr. Dept., Northern Pacific Ry. Co., Seattle, Wash.; Moses E. Shire, Engr. in charge, Chicago Union Transfer Ry. Co., Chicago, Ill.; John J. Vall, with Pennsylvania R. R. Co., Rahway, N. J. The following candidates were transferred from the grade of Associate Member to Member: Henry C. Allen, Albany, N. Y.; Clinton S. Burns, Kansas City, Mo.; William C. Tucker, New York City; Daniel L. Turner, New York City; Wilbur J. Watson, Cleveland, Ohio.

CONTRACTING NEWS

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DEPARTMENT

WATER.

Phoenix, Ariz.—Bids will be received Jan. 28, by the Comr. Indian Affairs, Dept. Interior, Washington, D. C., (A. C. Tanner, Acting Comr.) for furnishing material and constructing water system in Phoenix School. For further information, apply to Chas. W. Goodman, Supt., Phoenix.

Fullerton, Cal.—The directors of the Anaheim Union Water Co., which supplies irrigation water for Fullerton, Anaheim, Placentia and Brea, proposes to issue bonds to meet indebtedness, and to make needed improvements. Richard Melrose, Attorney.

San Diego, Cal.—Local press reports state that F. H. Dixon, Secy. Bd. Pub. Wks., will receive bids until Jan. 19, for constructing extensions to the water and sewer systems, including a c. i. water main, costing \$73,000, a wooden water main, cost \$26,000, and a sewer main, cost \$96,000.

San Francisco, Cal.—The Supervs. have ordered that condemnation proceedings be instituted to acquire a 43-acre tract of land to be used as reservoir site, a part of the proposed high-pressure fire-protection system.

Santa Ana, Cal.—The citizens are reported to have voted Dec. 20 to issue \$100,000 bonds to improve and extend the water works.

Riverside, Cal.—See "Power Plants, Gas and Electricity."

Pacific Grove, Cal.—B. A. Eardley, of Pacific Grove, Supt. Pacific Improvement Co., writes that about \$100,000 will be expended on improvements. According to reports, it is proposed to construct a pumping plant, enlarge the reservoir and sink 6 new wells.

Greeley, Colo.—The Eastman Canal & Reservoir Co. has filed articles of incorporation for the purpose of building and maintaining 19 reservoirs, 15 miles north of Greeley, near Dover, Colo., in the vicinity of the Union Pacific R. R. The reservoirs are situated in 18 sections of land in township 9 and range 65, and will draw water from Eastman, Owl, Little Owl and Robinson creeks, and will hold 1,000,000,000 cu. ft. of water. Directors: Benj. A. Johnson, John C. Murray, Saml F. Martin and others.

Wilmington, Del.—The Bd. of Water Comrs. on Dec. 31 decided to enter into contract with E. I. Du Pont de Nemours Powder Co., Jos. Bancroft & Sons Co., and Jessup & Moore Paper Co., the owners of water rights up the Brandywine, for water for the proposed new city system, which means an intention to adopt the Red Bank project. A report was read from Engr. Saml M. Gray, of Providence, R. I., in which he favored the 9th Ward project, settling forth that in his opinion it was entirely feasible and more economical than any other, there being a saving of \$176,000 in the first cost over the Weldin farm project.

Atlanta, Ga.—Frank P. Rice, Pres. Bd. of Water Comrs., in his annual report recommends the construction of an additional reservoir, the laying of a duplicate 36-in. main from the river to the present and new reservoir, and the increasing of the filter capacity.

Newcastle, Ind.—The John H. McGowan Co., of Cincinnati, O., is stated to have secured the contract for a pump and engine for the water station, at \$5,500.

Des Moines, Ia.—The Des Moines Water Works Co. is reported to be considering the laying of an additional water main to Highland Park, on east side of river, by way of Danish College. This will necessitate the laying of over 2 miles of new pipe.

Humboldt, Kan.—J. E. Wakefield, Mayor, writes that the citizens voted on Dec. 29 to construct water works.

Smith's Grove, Ky.—J. R. Kirby, Mgr. Smith's Grove Water Wks., writes that bids will be received in March or April for water works, to cost \$10,000.

New Orleans, La.—All bids opened on Nov. 9 by the Sewerage and Water Bd. for furnishing and erecting pumping machinery have been rejected, and new bids will be received. The machinery required consists of four 20,000,000-gal. pumping engines, three 40,000,000-gal. centrifugal pumps, 3 engines, two 150-hp. generators, 2 engines for these generators, six 400-h.p. water-tube boilers, and all steam and air pipe connections, etc. Geo. G. Earl, Gen. Supt.

Worcester, Mass.—The City Council Com. on Finance, acting under recommendations made by Mayor Walter H. Blodget, on Dec. 27 voted to favor two orders, one providing for the negotiation of a loan of \$50,000 for surveys and plans for the development of the proposed Asnebumskit water system and another for the preparation of said plans and surveys by the city engineer, who shall submit them to the City Council, the latter body to decide whether the work shall proceed either in the way which has been pursued by the city heretofore or by a commission authorized to take charge of the further development of the present watersheds and also that of the Asnebumskit shed.

Salem, Mass.—Mayor Peterson, in his annual message, recommends the installation of meters throughout the city.

Taunton, Mass.—The City Council has appropriated \$15,000 for general construction purposes of Water Dept. to be used for the purchase of supplies and protection of water supply from pollution.

Brookline, Mass.—Alexis H. French, Town Engr., writes that the citizens voted Dec. 28 to adopt the plan of metering all water supplied, and to appropriate \$15,000 for installing the water meters.

Lawrence, Mass.—The Lynchburg Fdy. Co., Lynchburg, Va., is stated to have secured the contract for 2, 6 and 8-in. iron pipe (bids opened Dec. 22) for \$3,697.

Grand Rapids, Mich.—The Bd. of Pub. Wks. has in view extension of the intake from present pumping station up the river about 16,000 ft. to take water at a point above local sources of contamination. Plans and estimates are being prepared. L. W. Anderson, City Engr.

Parker's Prairie, Minn.—Bids will be received Jan. 14 by the Village Council for \$8,000 water-works bonds. A. J. Campbell, Village Recorder.

Thief River Falls, Minn.—The Council is reported to be considering the question of establishing water works and a sewerage system.

Parker's Prairie, Minn.—J. Campbell, Village Recorder, writes that the Des Moines Bridge & Iron Wks., of Des Moines, Ia., has secured the contract for constructing water works, for \$6,400.

De Soto, Mo.—E. J. Mahoney, City Clk., writes that work is about to be commenced on the construction of water works, to cost \$70,000. Engineer, John J. Hainsworth, Room 606, Roe Bldg., St. Louis. Contractor, H. D. Hallett, of De Soto.

Springfield, Mo.—The special committee appointed by City Council to investigate the advisability of a universal use of house filters, has reported favorably, advising that they be purchased in large quantities by the city, and dispensed to consumers at a minimum cost.

Garfield, N. J.—The Council is stated to have granted the Special Com. on Municipal Water Plant, permission to secure bids on the probable cost of plans for water works.

Lumberton, N. J.—Spencer H. Powell, Township Clk., writes that it is proposed to construct municipal water works, at a cost of \$10,000. Engineer, Geo. F. Ried.

Arcade, N. Y.—G. A. Barnes, Village Clk., writes that it was voted Dec. 27 to purchase the plant of the Wyoming & Cattaraugus Water Supply Co.

Gloversville, N. Y.—The Bd. of Water Comrs. is stated to have decided to lay water mains on Forest, Wells, Eagle and Main Sts. and Steele Ave. A 16-in. main will be laid in Main St. from Green Ave. to Fulton St.

New York, N. Y.—Bids will be received Jan. 11 by John T. Oakley, Comr. Water Supply, Gas and Electricity, for furnishing and delivering stop cocks, hydrants, hydrant heads, wooden hydrant boxes, c. i. stop cock boxes and covers, manhole heads and covers.

Louisburg, N. C.—Bids are wanted Jan. 23 for the construction of water works and a sewerage system, as advertised in The Engineering Record.

Asheville, N. C.—The following are the bids opened by the Bd. of Aldermen on Dec. 23 for constructing a 16-in. water main from the standpoint to Oak and College Sts.: J. P. Rich & Son, \$9,933, and Kelly & Felthaus, \$9,869.

Newark, O.—Bids will be received Jan. 21 by the Bd. Pub. Service, for furnishing material and constructing water works. Frank T. Maurath, Clk.

Barberton, O.—The council on Dec. 27 voted to issue \$15,000 bonds to complete the new pumping station.

Brooklyn, N. Y.—The following are the bids opened on Dec. 28 by Martin W. Littleton, Pres. Brooklyn Boro., for furnishing all labor and materials required for altering, repairing and reconstructing sewer in Knickerbocker Ave., from George St. to Johnson Ave.: (a) Jas. H. Holmes & Co., (b) Sigretto & Maninno Co., (c) John J. Creem, (d) Michael J. Dady, (e) H. A. Rutan & Co., (f) Henry Newman, (g) United Eng. Contr. Co.:

	a.	b.	c.	d.	e.	f.	g.
1,750 cu. yd. brick masonry...	\$11.00	\$12.00	\$15.00	\$10.00	\$11.00	\$20.00	\$18.00
1,720 " " conc'te. Class A.	9.00	8.00	15.00	8.00	7.28	5.90	8.90
4,500 " " conc'te. Class B.	7.00	7.50	11.00	7.00	6.45	5.90	8.70
299 tons steel I-beams, etc.	75.00	50.00	60.00	60.00	53.00	80.00	70.00
74 tons cor'd steel rods.	70.00	45.00	100.00	60.00	50.00	80.00	100.00
440 sq. ft. metal lath.	.05	.05	.10	.06	.12	.50	.10
11,900 " " galv. stl. cloth.	.05	.05	.05	.10	.20	.05	.10
17,900 cu. yd. excavation	1.23	1.83	1.00	3.00	1.40	1.80	2.72
335 " ft. slgt. and bracing	25.00	18.00	.01	25.00	17.50	.01	32.50
5 " foundation plank	21.00	18.00	20.00	25.00	17.50	.01	52.00
15 manhole heads & covers	13.00	40.00	10.00	60.00	11.50	10.00	20.00
Totals	\$125,144	\$126,884	\$145,682	\$149,456	\$113,976	\$134,726	\$175,657

+Wire woven cloth, No. 20 gauge, 1/2-in. mesh.

Millersburg, Pa.—A charter has been granted to the Hughesville Home Water Co., of Millersburg, to supply water to Hughesville: capital, \$25,000. Incorporators: H. G. Frederick, T. F. Bradenbaugh and E. R. Bradenbaugh, of Millersburg.

Canadian, Tex.—See "Power Plants, Gas and Electricity."

Dallas, Tex.—Bids are wanted Jan. 24, for sinking a deep artesian well here. J. B. Winslett, City Secy.

Rockford, Wash.—J. B. Gilbert, City Clk., writes that F. B. Sherman & Co., of Chicago, Ill., has secured the contract for constructing water works (bids opened Dec. 1). Cost reported to be about \$5,300.

Aberdeen, Wash.—P. F. Clark, City Clk., writes that J. E. Simpson has secured the contract for constructing a reservoir (bids opened Dec. 21) for \$1,400.

Basin, Wyo.—A. McDonald, of Basin, is reported interested in the construction of an irrigation canal to take water from the river near this city, and reclaim 20,000 acres of land east of town.

**Santiago de Cuba, Cuba.*—Juan M. Portuondo, Ch. Engr., Dist. of Santiago, writes that the following are the bids opened on Dec. 15 for the construction of a city water supply: M. J. Dady & Co., Cardenas, \$459,958; M. P. Marceaux, Havana, \$406,873; Eduardo J. Chibás, Santiago de Cuba, \$415,618; The Snare & Triest Co., Havana, \$380,869 (awarded contract); F. Aguilera & S. I. Wilkinson, Santiago de Cuba, \$412,513, and Juan Real, Santiago de Cuba, \$410,926.

SEWERAGE AND SEWAGE DISPOSAL.

Los Angeles, Cal.—It is stated that bids are wanted Feb. 7 for constructing a sewer to connect contagious ward of county hospital with main sewer. C. G. Keyes, Co. Clk.

San Diego, Cal.—See "Water."

Redondo, Cal.—A. M. Harter, City Clk., writes that there is talk of constructing a sewerage system, but the preliminary estimates have not yet been made.

Oxnard, Cal.—C. J. Elliott, City Clk., writes that the probable cost of the proposed sewerage system is \$30,000.

Riverside, Cal.—See "Power Plants Gas and Electricity."

Jewett City, Conn.—Bids will be received Jan. 17 by Ira F. Lewis, Warden, for constructing sewers here.

Atlanta, Ga.—The Sewer Com. of Council (Philip Breitenbucher, Chmn.), in its annual report to Council recommends the purifying of the city's sewage by the erection of septic tanks at the mouths of various trunk sewers, where they strike the city limits.

Monmenc, Ill.—Bids will be opened at the office of E. P. Harney, City Attorney, Jan. 16, for constructing 10 blocks of sewer, to cost \$3,100.

Bloomington, Ill.—Bids are wanted Jan. 12 for 1,150 ft. of pipe sewers on Seminary Ave. and Mason St. Elmer Folsom, City Engr.

Mt. Vernon, Ill.—The Iowa Eng. Co. of Clinton, Ia., has prepared plans for a complete sanitary sewerage system and septic tank.

Monticello, Ind.—Bids are wanted Jan. 10 for constructing sewer No. 22. W. J. Gridley, Clk. Bd. Pub. Wks.

New Orleans, La.—All bids opened on Nov. 30 by the Sewerage & Water Bd. (Geo. G. Earl, Gen. Supt.), for the construction of about 16,000 lin. ft. of wood lined canals, have been rejected and new bids will be received. For detailed bids received for this work, see issue of The Engineering Record of Dec. 10.

Pittsfield, Mass.—The Bd. of Pub. Wks. is reported to be considering the question of purchasing a duplicate pump for the sewage disposal station.

Pontiac, Mich.—See "Bridges."

Coldwater, Mich.—Bids will be received Jan. 26 by the Bd. Pub. Wks. for constructing 10,076 lin. ft. 10 to 24-in. sanitary sewers together with necessary manholes. W. H. King, City Clk.

Thief River Falls, Minn.—See "Water."

Collingswood, N. J.—See "Paving and Road-making."

Brooklyn, N. Y.—Bids will be received Jan. 18 by Martin W. Littleton, Boro. Pres., for furnishing material and constructing sewer in portions of Butler and 9th Sts., Benson and Utrecht Aves. Engineer's estimate: 2,820 lin. ft. 12, 15, 18 and 24-in. pipe sewer, 28 manholes, 7 sewer basins, etc.

Syracuse, N. Y.—Emil Kuichling, of Rochester, has been engaged as Consulting Engineer, to report on plans prepared by the city engineering department, for the improvement of Onondaga Creek; according to press reports the probable cost of the work is \$300,000. Frank J. Schnauber, City Engr.

Hillsboro, N. C.—J. H. Webb, Treas. Eno Cotton Mills, writes that the company proposes constructing a sewage disposal plant.

Louisburg, N. C.—See "Water."

Durham, N. C.—Jas. Webb, Jr., of Hillsboro, is reported interested in the construction of a sewerage disposal plant for Durham.

Leetonia, O.—Williams & Whitman, 902 Whitehall Bldg., New York, N. Y., are preparing preliminary plans for a sewerage system and disposal plant for Leetonia.

*Items marked thus give the names of parties awarded contracts.

Barderton, O.—Engr. Collins estimates the cost of reconstructing the main sewer of Sanitary Sewer District No. 1, at \$5,500.

Urbana, O.—The city is reported to be about to take preliminary steps toward the construction of a sewerage system and sewage disposal plant. Jas. B. Johnson, Mayor.

Providence, R. I.—Herbert E. Wood, Secy. Dept. Pub. Wks., writes that Edwin D. Allen, of Providence, has secured the contract for pipe for sewer work (bids opened Dec. 16) for \$6,087.

Marion, S. C.—It is stated that bids will be received Jan. 10 by the Comrs. Pub. Wks. from Civil Engrs. for plans and specifications for a sewer system. P. B. Hamer, Clk.

Sioux Falls, S. D.—It is proposed to construct 3 blocks of 30-in. intercepting sewer; estimated cost \$8,000. S. B. Howe, City Engr.

Beaumont, Tex.—Geo. W. Sykes, City Engr., writes that the following are the bids opened on Dec. 17 by the Sewerage Com. for constructing an extension of the sewerage system (bids all of Beaumont): Callaghan & Graham, \$25,837; R. E. Reynolds Co., \$26,595; Ed. E. Eastham, \$26,276, and Myrick Bros. Co., \$26,398.

Victoria, Tex.—The City Council is reported to have ordered a survey and estimates made for a sewerage system.

San Antonio, Tex.—John D. Rullman, City Engr., writes that a petition is before City Council asking for sanitary sewers on Laurel Heights, Dist. No. 1, at a cost of \$26,000.

Houston, Tex.—It is stated that bids are wanted Jan. 11 for constructing a 4-ft. metal concrete sewer, with catch-basin. John W. Maxey, Engr., 203 Binz Bldg.

Seattle, Wash.—T. Ryan, is stated to have secured the contract for the construction of a sewer on 24th Ave. S. (bids opened Dec. 24) for \$5,379.

BRIDGES.

Santa Barbara, Cal.—It is stated that bids will be received Feb. 6 by C. A. Hunt, Clk. Bd. Supervs., for furnishing material and constructing a bridge over Sisquoc River.

Chicago, Ill.—Comr. Blocki is stated to have awarded the contract for constructing the Archer Ave. Bridge to the following: Fitzsimmons-Connell Co., Tacoma Bldg., substructure, \$61,324, and Roemheld-Gallery Co., 719 Chamber Commerce Bldg., superstructure, \$83,950.

New Haven, Ky.—The Nelson County Fiscal Court at Bardston, is stated to have recommended the acceptance of the bid of the Brakett Bridge Co., of Cincinnati, O., for constructing a bridge here, at their bid of \$5,300.

Hoopeston, Ill.—It is stated that bids are wanted Jan. 12 for constructing a 100-ft. highway bridge on 85 cu. yds. squared stone masonry or concrete. Address Wm. Kavanaugh.

Ionia, Mich.—Frank W. Gardner, City Clk., writes that it was voted Dec. 27 to issue \$25,000 bonds for a bridge to be constructed on the Cleveland St. extension.

Pontiac, Mich.—Press reports state that bids will be received Jan. 23 by the Common Council for \$16,000 bonds, \$13,000 of which to be used for reconstructing 7 wooden bridges and \$3,000 to be city's portion toward constructing lateral sewers.

St. Paul, Minn.—A. W. Van Hafften & Co., of Minneapolis, is stated to have submitted the lowest bid for redoing and repaving the Third St. Bridge, at \$10,989.

Forsyth, Mont.—Wm. S. Hewitt & Co., of Minneapolis, Minn., are stated to have received the contract for constructing a steel bridge over Yellowstone River here, for \$53,820. The structure to be 850 ft. long, consisting of 3 spans, with 2 concrete piers in center and tubular piers on each bank.

Brooklyn, N. Y.—See "Electric Railways."

New York, N. Y.—The following are the bids opened in Dec. 22 by the Dept. of Parks, for constructing a one-arch bridge in the Botanical Garden in Bronx Park; (a) G. I. Bailey, 1199 Fulton Ave.; (b) Jos. Gallo, 127 Mulberry St.; (c) Guidone & Galaxidi, 114 E. 23d St.; (d) Kelly & Kelley, 45 E. 42d St.; (e) M. J. Leahy, 1446 Prospect Ave.; (f) E. V. Smith Contr. Co., 125th St. and Lexington Ave.; (g) Snare & Triest Co., 39 Cortlandt St.; (h) Waters & O'Connell, 587 E. 42d St.:

	a.	b.	c.	d.	e.	f.	g.	h.
Stone arch bridge	\$37,368	\$35,500	\$32,785	\$35,326	\$32,000	\$46,000	\$41,000	\$35,994
10,000 ft. piers driven & cut	\$0.45	\$0.10	\$0.10	\$0.60	\$0.40	....	\$0.15	\$0.33
20 M. ft. yel. pine & bolts	45.00	1.00	1.00	60.00	40.00	....	20.00	42.00
600 cu. yd. extra rubble	6.50	1.00	8.00	7.00	6.50	....	2.50	5.50
100 " extra concrete	5.50	8.00	1.50	7.00	6.50	....	3.00	8.00
Totals	\$49,218	\$37,920	\$38,755	\$101,426	\$41,350	\$46,000	\$44,700	\$44,232

Cold Spring, N. Y.—The following are the bids opened on Dec. 27 by Chas. S. Boyd, State Supt. of Pub. Wks., for the construction of a bridge over Seneca River, between Lyndersander and Salina: (a) Springfield Contr. Co., Springfield, Mass.; (b) Riverside Bridge Co., Wheeling, W. Va.; (c) King Bridge Co., Cleveland, O.; (d) Owego Bridge Co., Owego; (e) Canton Bridge Co., Canton, O.; (f) Seneca Contr. Co., Montour Falls:

	a.	b.	c.	d.	e.	f.
Removing old superstructure	\$1,000.00	\$500.00	\$500.00	\$600.00	\$500.00	\$200.00
3,600 cu. yd. excavation	.50	.65	.50	.40	.72	.55
830 " masonry excavation	1.00	1.00	1.50	2.00	.96	1.70
220 " fill for embankment	.50	.80	.25	.10	.35	.20
460 " gravel lining on approaches	1.00	1.50	1.00	1.25	1.50	1.50
2 " second-class concrete	18.00	15.00	30.00	25.00	30.00	24.00
51 " first-class concrete	6.00	8.00	9.00	12.00	7.00	10.00
250 " second-class concrete	5.00	6.00	8.00	9.50	6.00	7.00
6,800 lbs. steel rod reinforcement of concrete	.045	.03	.045	.06	.035	.035
38 piles, 25-ft. long	12.00	6.00	7.50	12.50	6.03	12.50
38 " 35-ft. "	17.00	8.00	16.00	16.50	8.45	19.25
6 " 40-ft. "	21.00	9.50	12.00	18.50	9.66	24.00
100 Hn. ft. wood fence	.50	.16	.50	.25	.16	.25
288,000 lbs. steel in superstructure	.045	.0425	3.85	.0425	4.29	4.75
21 M. ft. lumber	35.00	40.00	36.00	40.00	35.00	....
Allowance for old superstructure	500.00	500.00	500.00	500.00	500.00	500.00

*Items marked thus give the names of parties awarded contracts.

Lockland, O.—Frank Krug, County Engr., is stated to have estimated the cost of constructing an electrical lift bridge over the canal at Benson St., at about \$24,814 and according to reports he was authorized to prepare plans and specifications for the structure.

Akron, O.—See "Electric Railways."

Cincinnati, O.—The City Council is stated to have approved the plans prepared for the Harrison Ave. viaduct to be constructed at Harrison Ave. and Barnard St., at a cost of \$275,000.

Harrisburg, Pa.—The Bd. of Pub. Bldgs. and Grounds is stated to have awarded the contract for constructing a bridge over Nescopeck, Luzerne County, to Nelson & Buchanan, of Chambersburg, for \$10,844, and to the Penn Bridge Co., of New Brighton, the contract for building a bridge over Lackawaxen River at Seelyville, for \$16,100.

Spokane, Wash.—J. T. Omo, Secy. Bd. Pub. Wks., writes that A. F. Gill, City Engr., has prepared plans for the construction of a bridge at Olive Ave., to cost \$8,000. Plans are also under way for a steel bridge to be constructed on Havermale St., to cost about \$16,000.

Chippewa Falls, Wis.—The Canton Bridge Co., Canton, O., is stated to have received the contracts for constructing the Jim's Falls and Holcombe bridges, for \$5,262 and \$5,153 respectively.

Milwaukee, Wis.—Alva J. Grover, of Milwaukee, is stated to have prepared plans for the Grand Ave. viaduct to be constructed here, at a cost of \$400,000.

PAVING AND ROADMAKING.

Birmingham, Ala.—The Nashville Roofing & Paving Co., of Nashville, Tenn., is stated to have received the contract for paving a portion of 5th Ave., for \$58,735. Bids opened Dec. 21.

San Francisco, Cal.—The City Engr. has just completed plans and specifications for paving a portion of Mission St. with asphalt; the work will cost about \$80,000.

Emeryville, Cal.—It is stated that bids will be received Jan. 21 by the Bd. City Trus., for grading, curbing and macadamizing San Pablo and Petalita Aves. and Magnolia St.

Wilmington, Del.—See "Power Plants, Gas and Electricity."

Chicago Heights, Ill.—J. C. Mote, Pres. Bd. Local Improv., writes that Jos. Orr, of Chicago Heights, has secured the contract for curbing, grading, and paving a portion of West End Ave. (bids opened Dec. 28) for \$15,000.

Indianapolis, Ind.—The following are the bids opened on Dec. 23 by the Park Bd. for constructing the Pleasant Run Boulevard: J. D. Hoss, 1734 Brookside Ave., \$52,000, and American Constr. Co., Indianapolis, \$48,500. This work consists of 4,000 ft. of roadway, either limestone, macadam, novaculite macadam, or bituminous macadam; roadway, 25 ft.; 5-ft. cement work; 1,900 ft. retaining wall (cement), varying in height from 10.5 ft. to 22 ft.

Louisville, Ky.—It is stated that bids will be received Jan. 16 by the Bd. Pub. Wks., for paving with brick 3 new alleys. J. H. Wellen, Chmn.

Boston, Mass.—The following are the bids opened on Dec. 27 by the Metropolitan Park Comm. (J. R. Rablin, Engr.), for grading roads in Mystic River Reservation, Medford, Somerville and Arlington; (a) Ruggles & Perkins, Boston; (b) Gow & Palmer, Boston; (c) Frank Williams, Boston; (d) Rowe & Perini, So. Framingham; (e) T. H. Gill & Co., Boston; (f) Coleman Bros., Everett (awarded contract):

	a.	b.	c.	d.	e.	f.
5,000 cu. yd. earth grading	\$0.56	....	....	....	....	....
50,000 " " " " " "	.97	.05	.75	.71	.64	.60
1,200 Hn. ft. 10-in. pipe drain	.60	.46	1.00	.70	.50	.50
600 " 12-in. " " " "	.75	.60	1.10	.85	.65	.70
600 " 15-in. " " " "	1.00	.78	1.25	.95	.75	.85
300 " 18-in. " " " "	1.25	6.00	4.50	8.50	5.00	5.00
15 cu. yd. rubble masonry	10.00	51.190	\$42,662	\$39,062	\$35,230	\$33,530
Totals	\$53,595	....	....	....	....	....

St. Paul, Minn.—The County Surveyor is stated to have submitted to the County Bd. specifications for the completion of the White Bear and Bald Eagle Roads, at an estimated cost of \$6,400.

Sussex, N. J.—Bids will be received Jan. 21, by the Boro. Council for macadamizing Hamburg and Newton Aves., Mill and Bank Sts.; also a portion of Clove Ave., in all about 7.18 Hn. ft. E. N. Millen, Boro. Engr. F. B. Whittle, Boro. Clk.

Jersey City, N. J.—The joint Freeholders' Com. of Essex and Hudson Counties, who have charge of the improvement of the Plank Road between Newark and Jersey City, at a meeting at Jersey City on Dec. 29, organized with Frank E. Ward, of Essex County, as Chmn. and John W. Griffin, of Hudson County, as Secy. Plans prepared under the joint supervision of the engineers of the two counties were approved. The new plank road will be 100 ft. wide. Bids will probably be called for early in the spring; probable cost of work \$1,000,000. Jas. Owen, Co. Engr., Newark; Jas. W. Leahy, Co. Engr., Jersey City.

Newark, N. J.—Bids will be received Jan. 9 by the Com. on Roads and Assessment of Bd. Chosen Freeholders for grading and paving with telford roads in Livingston, Verona, Belleville, West Orange and West Caldwell Townships, in all about 39,200 ft.; also about 13,250 ft. road on Wall St. and Stuyvesant Ave., in Boro. of Vailsburg. Wallace Ougheltree, Chmn.

Collingswood, N. J.—Bids will be received Jan. 17 by the Boro. Council, F. M. North, Clk., for furnishing material and constructing brick and pipe sewers, for macadamizing certain streets and for laying vitrified block gutters in said Boro.; also for cement or blue-stone curbing on certain streets. Earl Thomson, Engr. in Charge, Rm. 29 Security Trust Bldg., 301 Market St., Camden.

New York, N. Y.—The following are the bids opened on Dec. 29 by John F. Ahearn, Pres. Manhattan Boro., for regulating and repaving with asphalt on present pavement relaid as foundation, 37th St., from 7th to 10 Ave.; (a) Asphalt Constr. Co., 137th St. and Park Ave.; (b) U. S. & Venezuela Co., 1 B'way; (c) Sicilian Asphalt Co., Times Bldg.; (d) N. Y. & Bermudez Co., 114 Liberty St.; (e) Century Constr. Co., 7 E. 42d St.; (f) Warner-Quinlan Co., 32 Broadway:

	a.	b.	c.	d.	e.	f.
8,380 sq. yd. asphalt pavmt	\$1.00	\$1.05	\$1.10	\$1.18	\$1.20	\$1.30
8,400 sq. yd. old stone pavmt	.25	.40	.14	.31	.30	.35
4,760 Hn. ft. new blue-stone curb	.85	.82	.79	.87	.90	.90
120 " old curb reset	.30	.35	.35	.30	.35	.28
30 noiseless covers, complete	15.00	15.00	15.00	15.00	20.00	15.00
Totals	\$15,012	\$16,554	\$14,646	\$17,120	\$17,502	\$18,602

New York, N. Y.—The following are the bids opened Dec. 29 by John F. Ahearn, Pres. Manhattan Boro., for regulating and paving with asphalt block on concrete foundation 178th St., from Amsterdam Ave. to Broadway; (a) Harlem Contr. Co., (b) N. Y. & Bermudez Co., 114 Liberty St.:

	a.	b.
7,560 sq. yd. asp. block pavmt	\$1.53	\$1.55
1,100 cu. yd. concrete	5.60	4.16
200 Hn. ft. blue-stone curb	1.00	.82
2,900 " old curb reset	.27	.30
Total	\$18,710	\$17,328

Including mortar bed. Bids will be received Jan. 17 by Maurice Featherston, Comr. Docks, for furnishing material and paving with asphalt, decks of piers 60 and 61 and Bloomfield St. pier, North River, together with all work incidental thereto.

Geo. F. Scannel, Supt. Bureau of Highways, in a report to Borough President Ahearn, advocates the construction of a municipal asphalt plant.

Buffalo, N. Y.—Henry P. Burgard, Prudential Bldg., is stated to have submitted the lowest bids for paving with asphalt on a portion of Curtiss St., at \$37,500; also for paving on a portion of Stanislaus St., with brick 10,300, with asphalt \$9,500.

Poughkeepsie, N. Y.—The Co. Bd. of Superv. is stated to have passed a resolution providing for the improvement of 4 miles of the Hyde Park Road, at a cost of \$52,450, the county to pay \$26,225, and the State to pay a portion.

Asheville, N. C.—It is stated the City Engr. estimates the cost of paving with bituminous pavement on a portion of N. French Broad Ave., at \$5,859.

East Liverpool, O.—The report of the Engineer John A. George, of East Liverpool, on the cost of improving the road between this city and Wellsview, shows the approximate cost of the work to be \$21,000, mostly in excavation and culverts. This work is being taken up by the Good Roads Association.

The vote for sale of bonds for improving Calcutta Road, Liverpool Township, Columbiana Co., has carried, and bids will be taken on approximately 1 mile of grading and paving roadway with brick for a width of 16 ft. in the spring. Approximate estimate, \$40,000. Engr., John A. George, of East Liverpool.

Toledo, O.—The Bd. of Pub. Wks. is stated to have awarded contracts for paving as follows: Kerlin Bros., 416 Nasby Bldg., a portion of 13th St. with Logan block, for \$6,292; Wm. J. McMahon, 321 Floyd St., a portion of Machen St. with Canton block and 15th St. with Harris pavers, for \$3,998 and \$2,289, respectively.

Ironton, O.—Paving bonds amounting to \$43,000 are reported sold.

Ebensburg, Pa.—Bids will be received Jan. 31 by the State Highway Dept., at Harrisburg for constructing 5,645 ft. road from Summerhill to South Fork, in Croyle Township, in Cambria Co.

Philadelphia, Pa.—Both branches of City Council is stated to have passed an ordinance providing for the construction of a parkway from Logan Sq. to 25th St., at a possible cost of \$2,000,000.

Pittsburg, Pa.—The ordinance providing for the grading, paving and curbing on a portion of Frankstown Ave. is stated to have been recommended by the Com. on Pub. Wks.

Newport, R. I.—Mayor Boyle, in his annual message, recommends certain expenditures, among them for schools, small parks, the improvement of Long wharf and the building of a boulevard from Washington St. to the Middletown line.

Nashville, Tenn.—The City Council is stated to have passed a resolution providing for a bond issue of \$500,000 to improve the streets of suburban sections.

San Antonio, Tex.—John D. Rullman, City Engr., writes that the citizens voted on Dec. 21, to macadamize streets in Dist. No. 3, at a cost of \$38,000. He further states that petitions are before Council for a macadam pavement in Dist. No. 6, at a cost of \$43,000; street improvements in Dist. No. 9 to cost \$48,600 and for improvements in Dist. Nos. 7 and 8, at a cost of \$105,000.

Seattle, Wash.—Isaac Carlson, is stated to have received the contract for grading and constructing concrete walks on a portion of Republican St., for \$3,424.

POWER PLANTS, GAS AND ELECTRICITY.

Dothan, Ala.—Improvements contemplated to the city electric light plant include a 250-kw. revolving field alternator, a 375-h.p. engine and the changing of circuits (except power) from d. c. to a. c., and the installation of 50 series enclosed arcs.

Attalla, Ala.—The Mayor and Bd. of Aldermen are stated to have granted the Etowah Light & Power Co. permission to construct and maintain an electric light and power plant. A contract has also been made with the company to furnish lights for streets and stores and for the operation of the water works. It will furnish 2,000-c.p. arc lights, at 20 cts. per night for ea. arc light lamp, or at the rate of \$72 per arc light per yr.

Riverside, Cal.—Bids will be received Jan. 24 by the Comr. of Indian Affairs, Dept. Interior, (A. C. Tanner, Acting Comr.) Washington, D. C., for furnishing material and constructing extensions to water, sewer and electric lighting systems at Riverside School. For further information apply to Harwood Hall, Supt.

Wilmington, Del.—The City Council will ask the Legislature for permission to borrow \$200,000 for the construction of a municipal electric light plant; \$200,000 for a new city hall and \$400,000 for the betterment of the streets.

Washington, D. C.—Bids will be received Jan. 21 by Mr. DeLoach, T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, for a 29-panel switchboard in connection with power plant extension at U. S. Navy Yard here.

Bids will be received Jan. 17 at the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing at the navy yards, Mare Island, Cal., and Puget Sound, Wash., a quantity of electric wires, cable and conduit, meters, miscellaneous electrical material, brick, blocks, piles, iron, steel, asbestos pipe cover metallic tubing, pipe fittings, valves, etc. H. T. B. Harris, Paymaster-Gen., U. S. N.

Newnan, Ga.—E. D. Fouse, City Clk., writes that the city has purchased the electric light plant. It has not yet been determined what repairs will be made.

Atlanta, Ga.—Frank P. Rice, Pres. Bd. of Water Comrs., in his annual report recommends the construction of a direct-connected electric light plant, to furnish light to the water works; probable cost, \$5,000.

Covington, Ga.—The building and machinery of the city light plant is reported to have been destroyed by an explosion on Dec. 27; loss about \$12,000.

Chicago, Ill.—Press reports state that the following are the bids opened Dec. 24 by City Electrician Ellicott for street lighting: For maintaining 11,000 gas mantles 1 street lamps—Albert Whitfield, \$2.40 ea. per yr.; Chicago Street Lighting Co., \$3.12; Peerless Gaslight Co., \$2.35.

For repairing and painting 11,000 lamp posts—John McLaughlin, 45 cts. ea.; Chi-

cago Street Lighting Co., 48 cts.; Peerless Gaslight Co., 51 cts.

For maintaining 4,000 gasoline lamps—The American Development Co., \$26.40 ea. per yr.

The Commonwealth Electric Co. bid \$103 ea. on 530 street arc lamps it has rented the city; the Chicago Suburban Water & Light Co. bid \$102.50 for the 120 arc lamps it has been renting the city.

Bangor, Me.—P. H. Coombs, City Engr., writes that action has been taken to consider the advisability of increasing the lighting plant. M. H. Rideout, City Electrician.

Kennebunk, Me.—The Kennebunk Electric Light Co. will probably add another unit next year.

Snowhill, Md.—The electric light plant is about to be enlarged to 1,800 lights, and two 46-kw. d. c. generators.

Boston, Mass.—The Common Council and the Bd. of Aldermen have passed an order authorizing the city to construct or lease or maintain one or more plants for the manufacture and distribution of gas and electricity.

Birmingham, Mich.—The Birmingham Gas Co. is reported organized to construct and maintain gas and electric light works in Birmingham; capital, \$15,000. Stockholders: John T. Holmes, Clay C. Cooper, and Ralph T. Aldrich, all of Detroit.

Battle Creek, Mich.—The Council is reported to have passed a resolution in favor of establishing a municipal gas plant.

Crystal, Mich.—A larger generator and a boiler will be installed at the electric light plant. Otis A. Sanford, Owner.

Marcellus, Mich.—Another engine will probably be installed at the municipal electric light plant.

Minneapolis, Minn.—At the City Council meeting, Dec. 30, the Minnesota Power & Trolley Co. was granted a 30-yr. franchise to maintain and operate a plant for supplying electric energy for power and light.

Duluth, Minn.—The National Ry. Contr. Co., of Boston, Mass., is reported to have secured the contract for the development of the water power of St. Louis River for the Great Northern Power Co., of which C. A. Duncan, of Duluth, is president, and Francis A. Cokefair is Ch. Engr.

McComb, Miss.—The McComb City Electric Light & Power Co., of McComb, is reported incorporated, with a capital of \$50,000.

Bozeman, Mont.—The Gallatin Light, Power & Ry. Co. will remodel its steam plant or install a large water-power plant the coming summer.

Hammononton, N. J.—The Hammononton Electric Light Co., of Hammononton, has been incorporated, to generate and distribute electric current for light, heat and power; capital, \$50,000. Incorporators: H. E. Woodman, C. E. Starr, and F. P. Reed, of Hammononton.

Keamy, N. J.—All bids opened on Dec. 28 for lighting the town have been rejected, and the Council on Dec. 28 passed a resolution providing for the construction of a municipal electric light plant, and authorized the Lighting Com. (Wm. K. Warnock, Chmn.) to engage an engineer to prepare complete plans and specifications for such a plant.

New York, N. Y.—The Northern Westchester Light & Power Co. is reported incorporated, with a capital of \$5,000, by R. S. Hull, Brooklyn; Alex. S. Andrews, Flushing, and John Larkin, of New York City, to light streets, public places, private buildings and power by electricity in Cortlandt, New Castle, Ossining, Pleasantville, Briar Cliff Manor, Croton and Tarrytown.

Governor's Island, N. Y.—Bids were wanted Jan. 16 for furnishing material and wiring quartermaster's warehouse and wharf buildings, installing electrical apparatus, etc., at Governor's Island. Maj. G. S. Bingham, Q. M., U. S. A., Army Bldg., New York.

Oneida, N. Y.—De Witt C. Haddock, C. E., of Oneida, writes, in regard to the Linekitt Falls water power, that contracts will not be let until about July 1; the cost of work will be about \$125,000.

New York, N. Y.—The Bd. of Estimate on Dec. 30 adopted a resolution appointing a commission to prepare general plans and specifications, with estimate of cost, of a municipal electric light plant. The Com. appointed on motion of the mayor is Nelson P. Lewis, Ch. Engr. Bd. of Estimate; Prof. Geo. G. Seaver, of Columbia University and T. Carey Hutchinson.

The following are the bids opened on Jan. 3 by C. B. J. Snyder, Supt. School Eds., for installing electric equipment in addition to and alterations in school No. 15, Manhattan Boro.: Reis & O'Donovan, \$8,840; Commercial Constr. Co., \$8,692, and O. K. Electrical Constr. Co., 725 Bway, \$8,200 (awarded contract).

Bids will be received Jan. 11 by John T. Oakley, Comr. of Water Supply, Gas and Electricity, for furnishing and delivering 500 lamp posts, 1,000 cross heads and 1,500 fire alarm lantern glasses.

Pittsburg, Pa.—An ordinance authorizing the letting of a contract for lighting the city, at a cost not to exceed \$400,000 for one year, was recommended by the Com. on Pub. Wks. on Dec. 27.

New Milford, Pa.—A. E. Snyder, of the New Milford Light & Power Co., writes that about \$4,500 will be expended for improvements, and bids will be taken at once.

Laurens, S. C.—It is proposed to replace the line of the municipal electric light system.

Sumter, S. C.—The Sumter Light & R. R. Co. has received a franchise for an electric light plant.

Dallas, Tex.—The Dallas Electric Light & Power Co. contemplates building a new power house.

Canadian, Tex.—J. F. Johnson writes that estimates are wanted at once for the construction of water works and an electric light plant.

Mineral Wells, Tex.—The Mineral Wells Electric Light, Power & Heating Co., of Mineral Wells, has been incorporated, with a capital of \$50,000, to supply light, heat and electric motor power. Incorporators: V. E. Lycan, of Edna, Mo.; D. G. Galbrith and Wm. D. Williams, of Ft. Worth.

Aberdeen, Wash.—The Ninemire & Morgan Co. is stated to have petitioned for a franchise for an electric light and steam-heating plant.

Ballard, Wash.—The City Council is stated to have granted L. V. Brewer a franchise to furnish electric light and power in the city for a period of 50 years.

Ft. Walla Walla, Wash.—Bids are wanted Jan. 31 for furnishing material and installing interior conduit and wiring for electric lighting in two double barracks at this post. Capt. Noble H. Creager, Q. M., U. S. A.

Manitowoc, Wis.—The West Side Electric Co. is stated to have secured a franchise, and will at once construct an electric plant, to cost about \$200,000.

Monroe, Wis.—It is reported that the Monroe Gas Co. will expend about \$30,000 in improving its plant.

Milwaukee, Wis.—The Milwaukee Coke & Gas Co. is reported to have decided to add 40 ovens to its present plant in Kinickinnick Valley, at a cost of \$500,000. Other improvements contemplated by the company will bring the cost up to \$2,000,000.

Campbellford, Ont.—It is proposed to install at the city electric light plant 2 units of 800-kw. each, direct-connected; speed, 200 r.p.m. W. J. Dossie, Chmn. Water Wks. and Electric Light Comrs.

Hastings, Ont.—Fowlds & Co. propose installing a 75-kw. a. c. generator. J. D. Berry, Pres.

ELECTRIC RAILWAYS.

Santa Clara, Cal.—The Santa Clara Interurban Ry. Co. has been incorporated by J. C. Campbell, W. H. Nelson and J. E. Parkinson, with a capital of \$5,000,000, to extend its line from San Mateo to Alum Rock Park, running through Redwood City, Menlo Park, Palo Alto, Mayfield, Mountain View, Sunnyvale, Santa Clara and San Jose.

Oakland, Cal.—The directors of the Oakland Traction Consolidated Co. have voted to increase the bonded indebtedness of the company to \$7,000,000. It is stated that the new debt is to be partly applied to increase the facilities of the company.

San Diego, Cal.—The San Diego Electric Ry. Co. has under construction and in contemplation numerous improvements to its system in this city. The company recently secured a franchise from the city for the extension of its lines from 5th and K Streets via K to 10th to M and out to Mt. Hope Cemetery. A franchise for the extension of the street railway from State and D Sts. along State to Ivy, thence to India, and along India to the Old Town, a distance of about 4 miles, has been applied for recently, and if secured, construction work will commence immediately.

Grand Junction, Colo.—A franchise has been granted Geo. Smith to construct an electric railway through Grand Junction. The road is to run from Palisades to Grand Junction and probably to Fruita.

Naugatuck, Conn.—It is announced that work on the construction of the street railway which the Naugatuck Valley Electric Co. proposes to build between Naugatuck and Seymour will be commenced next spring. The route runs through Beacon Falls. At both Naugatuck and Seymour the line will connect with the Connecticut Ry. & Lighting Company's system.

Tampa, Fla.—The City Council has granted a franchise for the construction of another street railway which covers the main streets in the eastern portion of the town, and on to Ybor City and Sulphur Springs. T. W. Smith and C. E. Ball, prominent real estate men; W. B. Gray, of the wholesale dry goods firm of Bentley, Gray & Co., and Geo. C. Warren, of the real estate firm of Beckwith, Henderson & Co., are reported interested.

Sweetwater, Ill.—Articles of incorporation have been filed with the County Recorder for the Springfield, Sweetwater & Peoria Electric Ry. Co., with a capital stock of \$2,500.

Kokomo, Ind.—The Kokomo Electric Constr. Co. has filed articles of incorporation, with a capital of \$20,000 to promote, finance, construct, equip, rent and operate street and interurban railroads and plants for the creation and distribution of electric and other heat, light and power, etc. Principal office will be in Kokomo. W. F. Norwood, C. O. Scott and G. H. Martgolf are the incorporators.

Rockport, Ind.—J. H. Larimer, Pres. of the new company incorporated to build an electric railway from this city to Indianapolis, is contracting for the right of way.

Indianapolis, Ind.—The Consolidated Traction Co. has increased its capital from \$300,000 to \$1,500,000, an amount sufficient to complete the construction of the road. The directors have decided to continue the road west to Covington and Danville. A spur will also be built to Almo, and into the coal fields near by.

At a meeting held in Claypool Block a short time ago, for the purpose of organizing a company to construct an electric railway from Terre Haute to Vincennes, it was determined to capitalize for not less than \$1,500,000; also that the line should be as near as possible an air line paralleling the E. & T. H. Ry. Dr. W. N. Heath was elected Secretary and also instructed to go over and locate the line with the company's engineer.

The proposed electric railway which is to connect Indianapolis, French Lick and points along the Ohio River, has filed articles of incorporation with the Secy. of State. The name of the new company is the Indianapolis & Ohio Valley Traction Co. Capital \$500,000. Directors: A. E. Kauve and Jos. H. Larimer, of Indianapolis, and Peter Backer, of Troy, Ind. The line will be from Indianapolis to Rockport, and will connect Troy, Tell City, Cannellton, St. Meinrod's, Ferdinand, French Lick, West Baden, Bedford, Bloomington and Nashville. The survey for the line will be begun at once by Butler Smith, Chf. Engr.

Biddeford, Me.—The Biddeford Pool Electric Ry. is said to have been financed. Chas. E. Atwood is treasurer of the company.

Bridgton, Me.—The R. R. Comrs. have approved the articles of incorporation of the Bridgton St. Ry. Company, which is to operate a road 1½ miles long in Bridgton.

Myersville, Md.—The Hagerstown Electric Ry. Co., of Hagerstown, Md., has asked Myersville Council for certain privileges. The company will build a depot and warehouse in that town.

Boston, Mass.—Petitions have been received from the Haverhill & Boxford and Maplewood & Danvers Street Rys., which are the connecting roads of the through line from Haverhill to Boston, for the Board's approval of locations granted by the Aldermen and Selectmen of cities and towns in which the roads are located. The Haverhill & Boxford also has approval of certain grants in Haverhill and Boxford with additional authority to construct on private land in said city and town, while the Maplewood & Danvers wants approval of location in the towns of Malden, Melrose, Saugus, Lynnfield, Peabody, Danvers, Middleton and Boxford. The company also asks for additional authority to construct on private land in Middleton and Boxford.

Minneapolis, Minn.—The Twin City Rapid Transit Co. has secured permission to establish and operate a new loop in the down town district.

Hattiesburg, Miss.—Press reports state that an interurban line is projected from Hattiesburg to Laurel, 29 miles. Address C. J. Abbott.

St. Louis, Mo.—Another electric railway to St. Charles may be built next year if the project of the backers of the scheme to build a line from Kansas City to St. Louis is carried out. J. D. Housman, former manager of the St. Louis, St. Charles & Western Ry. Co., it is said, has been asked to take charge of the work and extend his county cross-connecting line from University Heights on the Bonkomme Road to Missouri River, and thence into St. Charles.

Glendive, Mont.—A petition asking that a franchise be granted to the Glendive & Lower Valley Rapid Transit Co. for the construction of an electric railway from Glendive to Buford, N. D., a distance of 80 miles, has been presented to the Bd. of Co. Comrs. E. S. Baer and H. J. Haskell, of Glendive, and B. S. Adams, of Newlon, are reported interested.

Brooklyn, N. Y.—Bids will be received Jan. 19 by Geo. E. Best, Comr. of Bridges, N. Y. City, for constructing railway tracks and stairways, and reconstructing expansion joints on bridge over Newtown Creek, from Manhattan Ave., Boro. Brooklyn, to Vernon Ave., Boro. Queens.

Raleigh, N. C.—The Raleigh & Durham Passenger & Power Co., which plans to build a line from Raleigh to Durham, has been granted a franchise by the City Council.

Zanesville, O.—C. B. Hart and A. C. Caldwell, representing the Security Trust Co., of Wheeling, W. Va., announce that the company has arranged for the financing of the Southeastern Ohio Ry., Light & Power Co., of Zanesville; capital, \$600,000. The company will build to Crooksville, Posey and Sayre.

Wapakoneta, O.—The Sandusky Southwestern Ry. Co. is reported to have arranged for the financing of \$5,000,000 worth of bonds. Considerable construction work has already been done on this property.

Toledo, O.—It is reported that \$5,000,000 construction bonds of the Toledo, Columbus & Cincinnati Ry. Co. have been floated in New York. The company was originally organized about three years ago by Ellis Bartholomew, of Toledo, to build a line from Toledo to Columbus and Cincinnati. A short time ago the company was reorganized with E. C. Shinness as president. Wm. H. Luchtenberg, of Columbus, is also identified with the project. The Arbuckle-Ryan Co. is reported to have secured the contract for designing and supplying the steam equipment for the new plant of the Toledo & Indiana Ry. at Stryker, O.

Wilmington, O.—W. D. Riddell is chief promoter of the Wilmington & Hillsboro Traction Co., and arrangements are stated to have been completed for financing the proposition and that the road will undoubtedly be built next spring. It will extend from Wilmington to Hillsboro, a distance of 20 miles. At Hillsboro connection will be made with a line to Cincinnati.

Akron, O.—The Northern Ohio Traction & Light Co. is stated to have received a proposition from the city relative to its share of the cost of eliminating grade crossings; the city has offered to grant the company a 5½-yr. extension of franchises if it will pay ½ the city's share of the cost of viaducts on Mill St. and Exchange St. and ¼ of the total cost of a viaduct over the Cuyahoga Valley at Main St. and North Hill; also to make certain improvements.

Cleveland, O.—The Buckeye St. Ry. Co. has been incorporated, with \$1,000 capital, by J. H. Van Derveer, Edw. H. Tracey, S. D. Reed and others, to build a line from Canton to Akron.

The Terminal Constr. Company, of Cleveland, has been incorporated by F. W. Green, N. B. Wood, J. R. Zmunt and others, with a capital of \$10,000, to build an entrance into Cleveland for a new interurban line to Akron.

York, Pa.—The York Traction Co. has made a survey from its tracks on North St., across Duke St., to the Northern Central Ry. freight warehouse. It is said that the company proposes to extend the tracks to the warehouse.

Johnstown, Pa.—The Kennerly Coal & Coke Co., chartered this week, with a capital of \$1,000,000 to do business in Somerset County, with headquarters in Johnstown, proposes to build an electric railway to Bear's Creek, there to connect with the lines of the Johnstown Passenger Ry. Co.

Chattanooga, Tenn.—Application will be made at once, under the laws of Georgia, for a charter for the Tennessee-Georgia Interurban R. R. Co., with a capital of \$300,000, to construct and operate an electric railway between Chattanooga and Ducktown, Tenn., via Ringgold, Catoosa and other nearby Georgia points. S. W. Divine, of Chattanooga, is one of the incorporators.

San Marcos, Tex.—Judge B. G. Neighbors, an attorney of Hays County, is said to have secured financial backing for building an electric railway from San Marcos along the river, touching Martindale, Fentress, Staples, Prairie Lea, and terminating at Luling, on the Southern Pacific Ry.

Salt Lake City, Utah.—The franchise of the Utah Light & Ry. Co. to construct a line from 3d and 1st Sts. in a southerly direction to 5th St., has been extended one year by the committee on streets, provided that the company will extend its present line on 13th St. East to 3d South within 3 months.

Salt Lake City, Utah.—The City Council, at the request of B. Mahler, of Cleveland, O., has resumed consideration of the petition of the company of which he is the chief promoter, for a proposed interurban which, when completed, will extend from Payson to Logan. The extension of its electric railroad system, to Bingham Junction and the town of Sandy, is among the projects planned for the early spring by the Utah Light & Railway Co.

Milwaukee, Wis.—The Milwaukee Electric Ry. & Light Co. is stated to have decided to build an electric line from Waukesha to Oconomowoc, but it has not definitely decided when to build.

RAILROADS.

Oakland, Cal.—Press reports state that plans have been completed by the Southern Pacific R. R. for an extensive system of docks, warehouses, railroad yards and a seawall along the south side of the estuary between Alameda Point and the Webster St. bridge. Wm. Hood, Ch. Engr., San Francisco.

Boise, Idaho.—The San Francisco Idaho & Montana Ry. Co. has been incorporated, with a capital of \$50,000,000, to construct a railroad from San Francisco to Butte. Headquarters in Boise. Officials of the Western Surety Adjustment Co., and John A. McGinty, who has been engaged in preliminary work for the proposed road, are the incorporators.

Knoxville, Ia.—The Rock Island R. R. Co. is stated to have decided to construct a line from Knoxville to Indianola. W. L. Darling, Ch. Engr., Chicago, Ill.

Greensboro, N. C.—The Seaboard Air Line (F. H. Huger, Gen. Supt., Portsmouth, Va.) is reported to have in contemplation the extension of the Durham Branch to Greensboro and probably to Mt. Airy.

Minerva, O.—The Wabash R. R. (W. S. Newhall, Ch. Engr., St. Louis, Mo.) is reported to have decided to do extensive building in Ohio next summer. Orders have been issued for the construction of lines from Lisbon to Minerva, from New Galilee to New Castle and Elwood City, and from Lisbon to Washingtonville. A line from Negley south to the Ohio River at Wellsville and East Liverpool will be built. The company has spent \$360,000 for an entrance into Youngstown. These lines built, the Wabash will then tap the Mahoning Valley at two points and will have a continuous network of tracks between Pittsburg, Cleveland, Salem, Canton, Wheeling, Toledo, and their western system.

Philadelphia, Pa.—The Philadelphia & Reading Ry. Co. (William Hunter, Ch. Engr., Philadelphia), is reported to be planning extensive improvements along its New York Short Line, now under construction between Newtown Junction and Neshaing Falls.

*Items marked thus give the names of parties awarded contracts.

Bristol, Tenn.—Surveys will be completed by the Virginia & Southwestern Ry. Co. (J. H. McCue, Supt. of Bristol), for the construction of a line from Toms Creek on the line of the road to Cockswain, a distance of about 37 miles. Contracts will be let at once.

Charlotte, Tenn.—The citizens of Charlotte are reported to have voted on Dec. 27 to issue \$8,000 gold bonds for subscribing to the capital stock of the Tennessee Industrial Ry. Co. This is the proposed line from Harpeth, on Cumberland River, and on the Tennessee Central R. R., south through Dickson County, via Charlotte and intersecting the Nashville, Chattanooga & St. Louis Ry. at Pond, the terminus of the Clarksville Mineral Branch of the Louisville & Nashville R. R., then south through Hickman, Lewis and Wayne counties, Tenn., to Florence, Ala., on the Tennessee River and the Louisville & Nashville and Southern Railways.

Ft. Worth, Tex.—It is reported that the Oklahoma, Texas & Southwestern R. R. is to be extended from its present terminus to Ft. Worth. The road is to pass through Bowie, Montague, and other points en route to this city.

Galveston, Tex.—It is reported that the Santa Fe R. R. (W. C. Nixon, Gen. Mgr., Galveston), will build a connecting link of about 500 miles next year, which will give that road practically a direct route from Galveston to Los Angeles and San Francisco.

Sheboygan, Wis.—The North-Western R. R. (E. C. Carter, Ch. Engr., Chicago, Ill.), is stated to have appropriated \$500,000 for improvements, including the erection of a depot and the construction of a freight line through the western part of the city.

PUBLIC BUILDINGS.

Prattville, Ala.—The Co. Bd. of Revenue has accepted the plans submitted by the Bruce Architectural Co., of Birmingham, for the temple of justice which they propose erecting.

Pine Bluff, Ark.—Plans have been approved for the hospital which the Ladies' Hospital & Benevolent Assoc. intend erecting. It is reported that bids for the erection will soon be asked.

Los Angeles, Cal.—It is reported that plans have been completed for a \$40,000 addition which is to be erected to the convent of the Good Shepherd on 16th St.

Eureka, Cal.—The plans submitted by Jos. W. Rowell, of San Francisco, for the city hall have been accepted. Approximate cost \$90,000.

San Francisco, Cal.—The Superv. are now negotiating for the purchase of property to be used as a site for a new library. The library and equipment will cost about \$1,000,000.

Denver, Colo.—It is reported that the following bids were opened Dec. 20 by Frank W. Crocker, Chmn. Bldg. Com., for erecting the Carnegie Library: Frazer & Richardson, \$299,170; Frank Anderson, \$344,816.70; Frank Damascio, \$351,540; Geddes & Seerie, \$358,020; Stocker & Frazer, \$399,000.

Bids opened at the same time for a boiler-house for the library, it is reported, were as follows: Stocker & Frazer, \$17,350; Frazer & Richardson, \$15,462; Geddes & Seerie, \$17,500; Frank Damascio, \$16,645; Frank Anderson, \$19,675.

Leadville, Colo.—The following are the 3 lowest bids opened on Dec. 30 by the Superv. Archt., Treas. Dept., Washington, D. C., for furnishing the heating apparatus for the U. S. Post Office at Leadville: Bosworth, Hahn & Co., Wichita, Kan., \$4,181; E. J. McDonough Co., Chicago, Ill., \$3,625; and Mandy Bros., Leadville, \$4,100.

New Haven, Conn.—Bids will be received Jan. 17 by the Bd. Fire Comrs. at Headquarters of Dept. Fire Service for erecting engine-house, including mason and carpenter's work, plumbing and heating. Brown & Von Beren, Architects, 865 Chapel St.; S. J. Metzger, Secy.

Wilmington, Del.—See "Power Plants, Gas and Electricity."

Colquitt, Ga.—Alex. Blair, of Macon, Ga., it is reported, has completed plans for the court house to be erected in Miller County, at a cost of \$20,000.

Atlanta, Ga.—Mayor Jas. G. Woodward in his message to Council recommends the erection of a city hall, an armory and 2 new fire engine houses.

Dekalb, Ill.—Bids will be received Jan. 30 (extension of date) by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for constructing U. S. Post Office here.

Vincennes, Ind.—The following are the bids opened on Dec. 29 by the Superv. Archt., Treas. Dept., Washington, D. C., for the construction complete of the U. S. Post Office at Vincennes: J. A. Simpson, Lincoln, Neb., \$60,097; P. H. McCormack Co., Huntington, \$49,599; W. H. Bally, Henderson, Ky., \$56,742; Standard Const. Co., Chicago, Ill., \$48,670; C. W. Gindele Co., Chicago, Ill., \$53,500; Hanson Bros., Chicago, Ill., \$62,348; Latimer & Bennings, Kansas City, Mo., \$54,310; G. Maffioli, Rockford, Ill., \$60,500; John A. Schumacher Co., Indianapolis, \$50,500; and W. J. Turner Co., Philadelphia, Pa., \$53,478.

Rochester, Ind.—Andrew Carnegie has offered this city \$10,000 to erect a library and it is stated, the offer will be accepted.

Lafayette, Ind.—The Legislative Com., it is reported, has recommended an appropriation of \$15,000 for the erection of a dormitory at the State Soldiers' Home.

Peru, Ind.—It is stated that the Miami County Court House has been condemned and the Comrs. are taking steps to erect a new building at a cost of \$150,000.

Louisville, Ky.—Bids will be received Jan. 16 by Brinton B. Davis, Archt., 505-506 "The Masonic," for erecting an armory for Jefferson Co. Plans may be obtained on deposit of \$125 to be refunded on return of said plans. Probable cost, \$325,000.

New Orleans, La.—An ordinance has been passed by the Council authorizing the City Engr. to prepare plans for an engine house to be erected in the 9th Ward.

Baltimore, Md.—It is stated that Simonson & Peltich have been commissioned to prepare plans for the municipal building which is to be erected in the Center Market Space under the direction of the Center Market Com.

Lowell, Mass.—Mayor Casey, in his annual message, recommends the erection of a public hall, to replace Huntington Hall, recently burned.

Boston, Mass.—Bids will be received until Jan. 12 by the Trus. of the Medfield Insane Asylum, at office of Park & Kendall, Archts., 8 Beach St., Boston, for erecting a barn, buildings for tuberculosis patients and additions to dining rooms.

Natchez, Miss.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., for the construction, complete, of the U. S. Post Office at Natchez, as advertised in The Engineering Record.

St. Louis, Mo.—It is reported that Andrew Carnegie has approved the plans for the library and has donated \$1,000,000 for the purpose. F. M. Crunden, Librarian.

Concord, N. H.—The Governor and Council are stated to have recommended the enlargement of the State House at Concord, and will submit to Legislature a report accompanied with plans of the proposed addition, and recommending an appropriation of \$400,000 for the purpose.

Somerville, N. J.—The erection of a new court house, at a cost of about \$150,000, is reported under consideration.

New York, N. Y.—Plans have been filed for a 4-story brick and stone orphan asylum to be erected at Convent Ave. and 135th St. for the Orphans' Home and Asylum of the Protestant Episcopal Church of New York, at a cost of \$125,000. W. Powell Robins, Archt., 19 Liberty St.

Newburgh, N. Y.—It is stated that the erection of an addition to the court house at a cost of \$30,000 is being considered.

New York, N. Y.—The following are the bids opened on Dec. 29 by the Park Comrs. for furnishing material and erecting an addition to the greenhouse in Bronx Park: Buckley Realty Constr. Co., Times Bldg., \$11,950; Hitchings & Co., 233 Mercer St., \$12,150; Lord & Burnham Co., 1133 Bway., \$12,675; Chas. Meade & Co., 220 Bway., \$14,370; Springfield & Adamson, 424 E. 107th St., \$12,780; and Louis Wechsler, 1133 Bway., \$10,900.

The Bd. of Estimate and Apportionment on Dec. 30 approved the contract awarded to Frank Dobson, 219 E. 42d St., for the ventilating and heating apparatus for the N. Y. Public Library, at \$299,000.

At this meeting there was also made at the request of the Fire Comr., an appropriation of \$56,000, \$22,000 to be spent for an engine house in 161st St., near Amsterdam Ave., and \$34,000 to be spent on an engine house in 181st St., near Audubon Ave. The Mayor on Dec. 28 signed the ordinance providing for the issue of \$300,000 bonds, to provide means for the purchase of sites and the erection of buildings thereon for the Fire Dept.

Comstock, N. Y.—The Conn. in Lunacy, at Albany, it is reported has selected this town as the place in which it is proposed to erect a lunatic asylum, for which an appropriation of \$50,000 was made by the Legislature last winter.

National Military Home, O.—Bids will be received Jan. 10 at the office of John W. Byron, Commissary of Subsistence and Supt. Post Fund, Central Branch N. H. D. V. S., for erecting 3 greenhouses and office building here.

Cincinnati, O.—The pavilion plan for the new City Hospital and the Avondale site have been adopted by the Bd. Pub. Service. It is reported that an Advisory Bd. will be appointed to supervise the work of construction, and to select an archt. to prepare the detail plans.

Clifford Lakeman, Secy. Bd. Pub. Safety. writes that the contract for erecting a 2-story brick engine house on E. 12th St. (bids opened Jan. 3) has been awarded to L. Belmont, 1027 B'way, for \$10,748.

Taylor, Pa.—E. H. Davis, of Scranton, is preparing plans for a brick hospital to be erected here, comprising an administration building and two ward buildings. Contracts will probably soon be let.

***Norristown, Pa.**—Flissell & Wagner, 1133 B'way, New York, N. Y., has secured the contract for constructing complete the U. S. Post Office at Norristown, for \$39,200, and \$8,700 extra for a facing of blue marble.

Camden, S. C.—Bids are wanted Jan. 18 for erecting a court house. Plans and specifications will be furnished on deposit of \$25. J. M. Sowell, Ch. Surv.; Edwards & Walter, Archts., Columbia.

Ft. Moultrie, S. C.—Bids are wanted Jan. 31 for constructing central dispensary here. F. L. Buck, Q. M., U. S. A.

Ft. Meade, S. Dak.—Bids will be received until Jan. 19 by the Constr. Q. M., at Ft. Meade, for the construction, heating, plumbing and electric wiring of 2 sets of field officers' quarters, 1 double set of lieutenants' quarters, 1 double set of N. C. O. quarters, all of brick and for the construction of a frame stable; also at the same time for heating, plumbing and electric wiring 1 double barracks, and 1 double set of captains' quarters.

Edna, Tex.—It is reported that the proposition to issue \$50,000 Jackson County court house bonds carried at the recent election.

Dallas, Tex.—The Pub. Grounds and Bldg. Com. of the City Council, it is stated, has accepted plans prepared by Otto H. Lang, for the \$75,000 auditorium and exposition hall which is to be erected at the Fair Grounds. It is reported that the Secy. of the Com. has been authorized to receive bids at once for the erection of the building.

Denton, Tex.—The Attorney General has approved the issue of \$25,000 city hall bonds.

Richmond, Va.—The Finance Com. is reported to be in favor of accepting the offer of Andrew Carnegie to give this city \$100,000 for the establishment of a library, on condition that the city furnish a site and make arrangements for the maintenance of the building.

***Jonesville, Va.**—A. M. Goins, Secy. Jail Com., writes that the contract for erecting a jail (bids opened Jan. 2) has been awarded to the Pauly Jail Bldg. & Mfg. Co., of St. Louis, Mo., for \$9,710.

***Ft. Walla Walla, Wash.**—Thos. Jones and Chas. Cronton, of Port Townsend, it is reported, have received the contract for the plumbing work in the barracks, at about \$5,900.

Wheeling, W. Va.—The following are the bids opened on Jan. 3 by the Superv. Archt., Treas. Dept., Washington, D. C., for the construction of the U. S. Post Office at Wheeling: C. W. Gindele Co., Chicago, Ill., \$224,387; V. Jobst & Son, Peoria, Ill., \$256,434; Andrew Doll & Son, Cleveland, O. (two bids) \$225,500 and \$254,500; A. B. Stannard, New York, \$241,600; F. L. Stevenson Constr. Co., Dallas, Tex., \$243,400; N. E. Syler, Washington, D. C., \$234,000; Thos. Reilly, Philadelphia, Pa., \$239,953; Standard Constr. Co., Chicago, Ill., \$222,750; Brady Constr. Co., Fairmount, W. Va., \$299,777; Mankin Constr. Co., Richmond, Va., \$235,750; Miles & Bradt, Atlanta, \$268,000; Security Constr. Co., Wheeling, \$325,525; Richardson & Burgess, Washington, D. C., \$218,500; C. E. Carson, Chicago, Ill., \$237,739; Constable Bros. Co., Erie, Pa., \$279,333; Hamilton & Irwin Co., Wheeling, \$396,680; Henry Shenk Co., Erie, Pa., \$272,222; C. W. McCane Co., Philadelphia, Pa., \$226,995; J. E. & A. L. Pennock, Philadelphia, Pa., \$247,683; John C. Robinson, Chicago, Ill. (3 bids), \$228,117, \$225,717, and \$221,917; John Pierce, New York, N. Y., \$275,000; Flissell & Wagner, New York, N. Y., \$227,000; Cramp & Co., Philadelphia, Pa., \$230,437; Broderick & Wind, St. Louis, Mo. (2 bids), \$231,869 and \$231,864.

Ellsworth, Wis.—Plans prepared by Buehner & Orth, of St. Paul, Minn., for the new court house and for remodeling the old court house for a jail have been accepted. Estimated cost, \$85,000.

Chihuahua, Mex.—The City Council, it is reported, is about to receive plans in competition for a municipal building which is to be erected at a probable cost of \$200,000 including furnishings.

BUSINESS BUILDINGS.

Birmingham, Ala.—W. C. Weston, Woodward Bldg., it is stated, is the archt. for the 2-story and basement building which the City Paper Co. intends erecting on First Ave. Local press reports state that about Feb. 1 Chas. & H. B. Wheelock, Archts., Steiner Bldg., will ask bids for erecting the Masonic Temple at 6th Ave. and 19th St., which is to cost about \$40,000.

San Francisco, Cal.—Bliss & Faville, Crocker Bldg., are stated to have prepared plans for a 7-story fireproof building, 50x170 ft., to be erected in Market St., near Kearney.

***Bridgeport, Conn.**—Henry L. Norton, of Springfield, Mass., it is stated, has received the contract for erecting a 9-story steel-frame building, for N. & S. Wheeler, of Bridgeport, at a cost of about \$40,000.

***Chicago, Ill.**—The Thompson-Starrett Co., N. Y. City, it is reported, have received the contract to erect 8 buildings for Sears, Roebuck & Co., at Kedzie Ave. and Harvard St., the total cost to be about \$3,000,000.

Chester, Pa.—The 100 Warehouse St., has completed plans for a warehouse and stable to be erected at 18th St. and Indiana Ave., at a cost of \$100,000. The building will be leased by the owners, Cobe & McKinnon, to A. M. Rothschild. It has been decided that the improvements

to be made on the Morrison property at Clark and Madison Sts., is not to build an office building, but an 18-story hotel, to cost about \$850,000. Competitive plans are now being prepared. There will be between 450 and 500 guest rooms, each with private bathroom.

Richd. Loewenthal, dealer in rags and paper stock, has had plans prepared by A. K. Adler, Monadnock Bldg., for a 5-story mill constructed warehouse, 80x100 ft., to be erected at Morgan and 20th Sts., and to cost \$50,000.

Fred Lindquist, 90 Washington St., is preparing plans for a store and flat building to be erected at Colorado Ave. and W. Van Buren St. It will be three stories high, and cost \$55,000.

A 3-story store and flat building, 90x145 ft., is to be built at N. California Ave. and Frances Place, by Hanson Bros., at a cost of \$40,000.

Joseph Vehon has purchased a site at Fifth Ave. and Polk St., and will shortly begin the construction of a building, where the Royal Tailors will consolidate their general offices and manufacturing departments. The building will be 7 stories high, with foundations sufficiently strong to carry 5 more stories. Construction will be commenced May 1. The building will cost \$200,000.

Plans have been prepared by Barnett, Haynes & Barnett, of St. Louis, Mo., for a white marble building, which is to be erected at Michigan Ave. and Monroe St., for the Illinois Athletic Club, at an approximate cost of \$1,000,000.

Fire in this city on Dec. 30 is reported to have destroyed several buildings, including the repair barns of the Chicago Union Traction Co., at 40th St. and Western Ave., and the 7-story building occupied by the Cash Buyers' Union on W. Van Buren St., and the 4-story building adjoining, occupied by the Zeno Mfg. Co.; also the stables of the Fortune Bros. Brewing Co.

Ft. Wayne, Ind.—It is reported that the Majestic Theater has been destroyed by fire, and is to be rebuilt. Address Manager Rice.

Tulsa, Ind. T.—The St. Louis & San Francisco Ry., it is stated, will erect a depot here to cost \$30,000. W. H. Upton, Gen. Mgr., Sherman, Tex.

Sioux City, Ia.—Wilfred W. Beach, 721 Toy Bldg., has prepared plans for an 8-story office building which is to be erected on Pierce St. Wm. Gordon is reported interested in the project.

Louisville, Ky.—D. X. Murphy & Bro., 250 Fifth St., are preparing plans for the terminal station which the Louisville & Southern Indiana Traction Co. intends erecting at 3d Ave. and Market St.

Monroe, La.—It is reported that the officials of the St. Louis Iron Mountain & Southern R. R. have decided to build independently a depot in this city, of brick and stone, at a cost of about \$21,000. H. Rohwer, Ch. Engr., St. Louis, Mo.

Camden, Me.—The Livingston Mfg. Co., of Camden, propose erecting a fire-proof building, 60x100 ft. No new machinery will be required.

Myersville, Md.—See "Electric Railways."

Worcester, Mass.—E. P. Fitzgerald is preparing plans for a 4-story brick business block for Geo. T. Horan, of Charlestown, Mass., to cost \$25,000.

Lawrence, Mass.—John Ashton, 477 Essex St., is preparing plans for extensive alterations and additions to a business block leased by Robertson & Sutherland Co. for a department store. A. B. Sutherland, Resident Mgr.

Kalamazoo, Mich.—Wm. Thompson, Gen. Mgr. Kalamazoo Stove Co., writes that it is proposed to erect a 1-story warehouse, 300x214 ft., to cost about \$25,000. It is also proposed to construct a power house. Power machinery all contracted for.

Benton Harbor, Mich.—Chas. W. Weischans, pres. of the Hotel Benton, it is reported, has announced that he intends erecting a \$150,000 bath house annex to the hotel.

St. Paul, Minn.—It is reported that the Directors of the Y. M. C. A. have selected a site and decided to erect a building at a cost of \$100,000, instead of \$300,000, as at first proposed.

Jefferson, Mo.—The Jefferson Investment Co., it is reported, will erect a hotel next spring, at High and Madison Sts., at a cost of \$100,000.

St. Louis, Mo.—Mauran, Russell & Garden, 721 Garden St., is reported, are the archts. for the 1-story and basement brick, stone and terra cotta building which is to be erected for the Broadway Savings Trust Co., at Bway. and Chambers St.

***St. Joseph, Mo.**—It is reported that the Empire Storage & Warehouse Co. has awarded the contract to erect a 3-story brick warehouse at 4th and Franklin Sts. to Jos. Nason, at a cost of about \$35,000.

Jersey City, N. J.—The Bd. of Directors of the Erie R. R. it is reported, has accepted plans for the new terminal station which is to be erected at Pavonia Ave. It is stated that the officials of the Erie R. R. have appropriated \$8,000,000 for improvements in this city. W. H. Peddle, Supt. of Terminals, Jersey City.

The Commercial Trust Co., it is reported, is contemplating the erection of a 16-story office building on Exchange Place. J. Warren Hardenburgh, Pres.

New York, N. Y.—The members of the Automobile Club of America, it is reported, are contemplating the erection of a club house and garage at an approximate cost of \$420,000. Dave Hennen Morris, Pres. It is reported that the American Seamen's

Friend Society intends erecting next spring at Jane and West Sts., a building for the sailors, to cost about \$70,000. Henry H. Roberts, Shipping Master of the Seamen's Christian Assoc., may be able to give further information.

Brooklyn, N. Y.—See "Miscellaneous."

Toledo, O.—E. A. Fallis, "The Nasby," it is stated, is preparing plans for a heating plant for the Y. M. C. A. building, which is to cost about \$10,000.

Columbus, O.—The directors of the Y. M. C. A. are said to be considering the erection of a 6-story fireproof steel building, to cost about \$350,000.

Cincinnati, O.—The erection of an 11-story hotel on the Pike site is reported under consideration. Frank Andrews, Archt., of Dayton, O., may be able to give information.

Philadelphia, Pa.—John Blood & Co., mfrs., 7th and Somerset Sts., are about to erect a new building for storage purposes. Architects, Sterns & Castor, Stephen Girard Bldg.

Chester, Pa.—A. A. Protzman, Gen. Secy. Y. M. C. A., writes that it is proposed to erect an \$80,000 building. Contracts will probably not be let for 3 or 4 months.

McKeesport, Pa.—It is reported that R. T. Carothers is to erect a 4-story brick block on 5th Ave., at a cost of \$50,000.

Ft. Worth, Tex.—Madigan & Coon, owners of the property at Main and 8th Sts., it is reported, are having plans prepared for a 7-story building, which is to be known as Hotel Worth and will cost about \$200,000.

Seattle, Wash.—It is reported that Herman Quandt, has had plans prepared for a \$28,000 hotel which he intends erecting at 5th Ave. and Main St.

Rhineclander, Wis.—W. T. Seeger, of Ashland, it is reported, is organizing a company with a capital of \$20,000 for the purpose of erecting an opera house here.

Milwaukee, Wis.—A. K. Hamilton, it is reported, will remodel the building at Grand Ave. and 2d St., at a cost of about \$20,000.

H. G. Lotter, 427 Milwaukee St., it is stated, is preparing plans for a \$60,000 factory which is to be erected by the Enterprise Box Co.

NEW YORK, N. Y.

137 E 25th St., 10-story br and stone loft bldg.; c, \$210,000; o, Benoit Realty Co., a, Gordon, Tracy & Swartwout.

303 E 102d St., 6-story br and stone stores and tenements; total c, \$210,000; o, Hillman & Golding; a, Saxe & Smallheiser.

Park Ave and 119th St., 6-story br and stone store and tenement; c, \$35,000; o, Leon Tuchman; a, Horenburger & Straub.

BROOKLYN, N. Y.

Moore and White Sts., 2 5-story br stores and tenement; total c, \$44,000; o & a, A. Potruch.

CHURCHES AND DWELLINGS.

Denver, Colo.—Bearresson Bros., 512 Mack Bldg., are preparing plans for a residence for Alonzo Thompson, to cost \$50,000.

Boal & Harnois, 100 E. 16th Ave., are preparing plans for a brick and stone residence for Crawford Hill, to cost about \$45,000.

Chicago, Ill.—M. Drosdowitz will build at 4310 Grand Boulevard a 3-story apartment building to cost \$30,000.

Thos. McCall, 167 Dearborn Ave., is preparing plans for an apartment house which Jos. McCormack will erect at 66th St. and Monroe Ave. It will be 3 stories, 100x100 ft., and cost \$80,000.

Sheridan Road and Leland Ave. is to be improved by an apartment building, to be erected for McCarthy Bros. It will be a 3-story structure, 94x113 ft. Estimated cost \$80,000.

Decatur, Ill.—The members of the Grace M. E. Church, it is stated, are considering the erection of a new edifice and have \$18,000 available for the purpose. Plans have not yet been prepared. Address Pastor.

Boston, Mass.—Plans have been filed for a block of ten 3-story 3-family apartment houses, with a central court, to be erected on Beaumont St. and Lakeville Pl., Ward 22. Owner, Mrs. Ella C. Adams, 541 Centre St., Jamaica Plain Dist. Builder and architect, Benjamin Fox, 72 Devonshire Bldg. Estimated cost \$85,000.

St. Louis, Mo.—The members of the Hamilton Christian Church, it is reported, are considering the erection of a new edifice at a cost of \$25,000. W. J. Morley, Trus.

It is stated that bids will be received Jan. 15 by J. W. Wees, Archt., 520 Olive St., for erecting a Jewish temple, B'nai-Eli, of brick and Bedford stone on Spring and Glad Aves.; estimated cost \$60,000.

St. Joseph, Mo.—R. S. Geir, of Conrad, Ia., it is reported, has received the general contract to erect Francis St. Methodist Church, at Francis and 12th Sts., at a cost of \$57,000.

Brooklyn, N. Y.—Plans have been filed for a brick church to be erected at Arlington Ave. and Elton St. for the Congregation of the Arlington Evangelical Protestant Church, at a cost of \$50,000. H. R. Marshall, Archt., 3 W. 29th St., N. Y. City.

Acandale, O.—A 3-story flat is to be erected by Dr. A. Strashun, at Albany and Burnet Aves., at a cost of \$35,000.

Cincinnati, O.—Gaber & Woodward, it is stated, are preparing plans for a 4-story, 50x90 ft. flat, which is to be erected on Smith and John Sts., at a cost of about \$40,000.

Cleveland, O.—Mrs. Carrie B. Van Swerington, it is reported, is having plans prepared for a residence to be erected on Shaker Heights, at a cost of \$100,000.

Pittsburg, Pa.—Chas. Bickel, 524 Penn Ave., it is reported, has been commissioned to prepare plans for a brick and stone residence for A. J. Sunstein, to be erected on Bartlett St., at a cost of \$28,000.

Philadelphia, Pa.—A building permit has been granted to J. Wenzelberger, to erect a 2-story and basement granite church, 64x82 ft., at 16th and Christian Sts., for the First African Baptist Church; cost, \$25,000. Also to Louis J. Sommer, to make alteration to apartment house on Park Ave. and 41st St., for F. A. Poth; cost, \$22,000.

Lebanon, Pa.—It is reported that contracts will be let at once for erecting the Second Reformed Church, at a cost of about \$40,000. Rev. Harry N. Bassler, Pastor.

Pottstown, Pa.—Davidheiser & Wland, contractors of Pottstown, will erect an apartment house on High St. to cost \$15,000. Architect, Geo. L. Gehard, Reading.

Dallas, Tex.—The Trus. of the North Dallas Baptist Church, it is reported, have purchased a site on McKinney Ave. on which it is proposed erecting in the near future, a brick and stone church, costing about \$25,000.

The Trus. of the First Methodist Church here purchased a site at Wood and Harwood Sts. and will erect a new edifice at a cost of about \$100,000.

Houston, Tex.—A 2-story frame and brick residence will be erected for J. I. Thomson, to cost about \$20,000.

W. T. Carter will erect a 2-story brick and frame residence, to cost \$25,000.

Ogden, Utah.—Colbey Bros., it is reported, will erect 3 apartment houses in the near future, at a total cost of about \$60,000.

Upperville, Va.—Grafton Hall, owned by Col. Richd. H. Dulaney, which was recently destroyed by fire is to be rebuilt in the spring, at a cost of \$15,000.

La Crosse, Wis.—It is reported that Albert Gutzke, of LaCrosse, has secured the contract to erect the German Lutheran Church, at 21st & 7th. Shick & Roth, Archts., La Crosse.

Milwaukee, Wis.—Van Ryn & DeGelleke, 211 Grand Ave., it is reported, are the archts. for a 2-story brick flat which is to be erected at Cass and Michigan Sts.

E. Breilmaier & Sons, 602 2d St., it is stated, have prepared plans for a new edifice for the St. Lawrence Congregation, which is to replace the structure recently destroyed by fire. Cost \$50,000.

Waupaca, Wis.—Bids will be received until Jan. 23 by the Bldg. Com. of the Holy Ghost Church (J. F. Jensen, Chmn.), for erecting a new edifice.

NEW YORK, N. Y.

65 E 110th St., 6-story br and stone tenements; c, \$60,000; o, Cohen-Seplov; a, Bernstein & Bernstein.

Madison Ave. and 96th St., 6-story br and stone tenement; c, \$400,000; o, Cades Realty Co.; a, Clinton & Russell.

15th St and 6th Ave., 6-story br and stone tenements; total c, \$240,000; o, Meyer Hoffman and Isaac Robinson; a, Lorenz F J Weiher.

Mt Hope Pl and St Anthony Ave., 5 3-story br dwells; total c, \$70,000; o, Edwin C Dusenbury; a, Neville & Bagge.

BROOKLYN, N. Y.

Chauncey St and Hopkins Ave., 15 3-story br tenements; total c, \$135,000; o, I A Canfield; a, L Berger & Co.

SCHOOLS.

Birmingham, Ala.—The following bids are reported to have been received Dec. 24 for erecting the high school: (a) pressed brick; (b) stone; (c) common brick; T. C. Thompson & Bro., (a) \$99,900; (b) \$102,428; (c) \$3,828.75 less than the bid for pressed brick. Frederick Moesser & Co., (a) \$99,752; (b) \$104,557; (c) \$95,627. A. J. Krebs & Co., (a) \$98,395; (b) \$105,308; (c) \$94,293. Stockmar Constr. & Improv. Co., (a) \$94,987; (b) \$99,987; (c) \$4,600 less than pressed brick bid. Theo. Peonil & Co., (a) \$93,630; (b) \$104,880; (c) \$2,260 less than bid for pressed brick. Jefferson Constr. Co., (a) \$114,000; (c) \$3,500 less. Birmingham Bldg. & Improv. Co., (a) \$122,000. Caldwell & Drake, (a) \$95,653; (b) \$100,773; (c) \$7,482 less than bid for pressed brick. Southern Constr. Co., (a) \$121,238; (b) \$132,238; (c) \$113,386. C. W. Brown & Co., (a) \$92,900; (b) \$100,400. Pool & Tanner, (a) \$119,674; (b) \$122,987; (c) \$116,100. All \$119,674. Bids have been rejected, and bids will again be received Jan. 10 by Breeding & Whilldin, Archts., Rm. 15, Watts Bldg.

Ft. Mojave, Ariz.—Bids will be received Jan. 26, by the Com. Indian Affairs, Dept. Interior, Washington, D. C., (A. C. Tanner, Acting Comr.) for furnishing material and constructing a brick hospital, including plumbing and acetylene gas piping, at Ft. Mojave School. For further information apply to Duncan D. McArthur, Supt. Indian School, Mojave City.

Storrs, Conn.—The Trus. of the Connecticut Agricultural College are considering the erection of a brick dormitory, and it is reported are about to petition the General Assembly to appropriate \$40,000 for the purpose.

Seymour, Conn.—L. W. Robinson, of New Haven, has been commissioned to prepare plans for the addition to the school on Bank St. Appropriation, \$20,000. Jas. Swan, Chmn. Bd. Educ.

*Items marked thus give the names of parties awarded contracts.

Galena, Ill.—E. Grimm, Chmn. Com. on Bldgs., Bd. of Educ., writes that new bids will be received on Jan. 24 for erecting the high school; cost not to exceed \$40,000. Architect, L. M. Drack, of Rock Island.

Indianapolis, Ind.—The Bd. of Control of Butler College, it is reported, is contemplating the erection of a men's dormitory and gymnasium on Washington St., at an estimated cost of \$100,000.

Newtown, Ind.—The high school, it is reported, has been destroyed by fire, and is to be rebuilt. Loss stated to be \$60,000.

Oskaloosa, Ia.—It is reported that the National Holiness Assoc. has purchased a site east of this city and intends erecting a university at a cost of about \$500,000.

Iowa City, Ia.—Bids will be received by the Bd. of Regents of State University on Jan. 26, for moving the Science Building, as advertised in The Engineering Record.

Baltimore, Md.—C. Sheehan & Sons, of Baltimore, it is reported, have received the contract to erect school No. 10 at Hollins and Amity Sts., at \$17,425.

Andrew Carnegie, it is reported, has given \$263,000 to the Md. Institute School for Art and Design toward the erection of a building which is to cost about \$500,000.

Ann Arbor, Mich.—It is reported that the high school has been destroyed by fire.

Butte, Mont.—The following bids, it is reported, have been received for ventilating and heating and plumbing in the new addition to the high school: Eschle Plumbing Co., submitted a total bid at \$7,591 and Walter Allen a total bid at \$9,998. I. Kreuger, bid for ventilating and heating, \$6,642, and plumbing, \$2,182; and A. J. Walkker, ventilating and heating, \$6,946, and plumbing, \$1,627.

Long Island City, L. I., N. Y.—Bids will be received Jan. 16 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for constructing fire-escapes at School 14, Boro. Queens.

Leviston, N. Y.—It is stated that bids will be received Jan. 16 by the Bd. Educ. for erecting a school. John H. Coxhead, Archt., 928 Elliott Sq., Buffalo; T. A. Kerr, Secy.

New York, N. Y.—The following are the bids opened on Jan. 3 by C. B. J. Snyder, Supt. School Bldgs., for sanitary work of addition to and alterations in school No. 104, Manhattan Boro.: Jas. Harley, \$11,013; Jere J. Deady, \$11,467; Matthew J. Crowley, \$11,898; Jas. Fay, \$11,234; Wm. C. Ormond, \$14, Herbert St., Brooklyn, \$10,780 (awarded contract); Christ. Nally, \$11,897, and Frank J. Fee, \$14,500.

The following are the bids opened, same time and place, for installing, ventilating and heating apparatus, in addition to School No. 19, Bronx Boro.: Harry L. Phillip, \$6,742; Frank Dobson, \$6,971; Geo. A. Suter, \$8,641; United Heating Co., \$8,315; Gillis & Geoghegan, \$8,000; E. Rutzler Co., 178 Centre St., \$6,430 (awarded contract); Walker & Chambers, \$6,989.

Brooklyn, N. Y.—Bids will be received Jan. 16 by B. J. Snyder, Supt. School Bldgs., N. Y. City, for masonry and carpenter work in school No. 21; masonry, carpentry, sanitary and heating work in school No. 26; masonry, carpentry, heating and electric work in schools Nos. 107 and 108.

New Brighton, S. I., N. Y.—Bids will be received Jan. 16 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing ventilating and heating apparatus and electric equipment in school No. 12, Boro. Richmond.

New York, N. Y.—The following are the bids opened on Dec. 27 by C. B. J. Snyder, Supt. School Bldgs., for installing ventilating and heating apparatus in the following schools: (a) School No. 150, Manhattan Boro.; (b) School No. 37, Bronx Boro.; (c) School No. 85, Brooklyn Boro.: Frank Dobson, (a) \$41,731; (b) \$39,757; (c) \$36,778. Rossman & Bracken Co., (a) \$39,900; (b) \$39,100; (c) \$38,400. N. Y. Steam Fitting Co., (a) \$41,649; (b) \$40,425. Jas. Curran Mfg. Co., (a) \$38,694. Blake & Williams, (a) \$42,634; (b) \$37,190. E. Rutzler Co., (a) \$38,000; (b) \$36,900; (c) \$33,900. Geo. A. Suter, 112 Wooster St., (a) \$35,900 (awarded contract); (b) \$36,900 (awarded contract); (c) \$35,400. Ralph J. F. Gerstle Co., (a) \$45,321; (c) \$39,998. Walker & Chambers, 50 E. 20th St., (a) \$38,489; (b) \$37,278; (c) \$33,249 (awarded contract). United Htg. Co., (b) \$41,971; (c) \$39,203.

The following are the bids opened same time and place for sanitary work of additions to and alterations in school No. 83, Manhattan Boro.: Wm. C. Ormond, 14 Herbert St., Brooklyn, \$9,387 (awarded contract). Frank J. Fee, \$12,737. Chris. Nally, \$13,243. Matthew J. Crowley, \$9,713; Jere J. Deady, \$10,793; H. P. Mills & Bro., \$11,440. Jas. Fay, \$10,537.

Bids will be received Jan. 16 by C. B. J. Snyder, Supt. School Bldgs., for installing ventilating and heating apparatus in school No. 41, Boro. Bronx; also for installing electric equipment in schools Nos. 63 and 104, Boro. Manhattan.

Webster, N. D.—It is stated that bids will be received Jan. 30 by Alex. Cockburn, Clk. Webster School, Dist. No. 10, for erecting a 2-story and basement school; bids for heating and plumbing to be submitted separately.

Cincinnati, O.—Bids will be received Jan. 23 by the Bd. Educ. for erecting a 12-room school, including carpenter and brick masonry work, electric wiring, ventilating, heating, etc., on Clifton and McAlpin Aves.; bids will also be received on same date for erecting a 12-room school on Langdon and Trimble Aves. Jacob E. Cormany, Chmn. Bldg. Com.

Anncville, Pa.—The Trus. of the Lebanon Valley College are considering the rebuilding of the College buildings which were recently destroyed by fire. An administration building, hall of science, boys' dormitory and central heating and lighting plant are to be erected.

Philadelphia, Pa.—Plans and specifications are being prepared by E. F. Durang, 1,200 Chestnut St., for a parochial school, to be erected at 17th and Rinker Sts., for St. Monica's parish. It will be 3 stories high, with a finished basement, of stone and brick.

Shamokin, Pa.—The contract for the ventilating, heating and sanitation of the proposed 2 new 15-room schools has been awarded to G. R. Carpenter & Co., of Wilkesbarre, for \$12,482.

Harrisburg, Pa.—It is reported that the contract to erect an annex to the Technical High School has been secured by W. O. Weaver & Son, of Harrisburg, at \$35,813.

Pittsburg, Pa.—It is reported that the Bd. of Trus. of the Carnegie Technical School will probably be ready about Feb. 10 to let the first building contracts for the school.

Newport, R. I.—See "Paving and Road-making."

Rice Lake, Wis.—The School Bd., it is reported, is considering the erection of a \$40,000 school.

Delevan, Wis.—It is reported that a committee has been appointed to receive plans for a \$50,000 school. E. W. Walker, Clk.

STREET CLEANING AND GARBAGE DISPOSAL.

Lowell, Mass.—Both branches of Council have passed the order for a \$10,000 garbage crematory.

Woburn, Mass.—Mayor Reade, in his annual message, recommends that proper disposition of garbage and refuse be acted upon without delay.

Lakeview, O.—It is stated that bids will be received Jan. 16, by the Bd. Health for collecting garbage. H. J. Sensel, Village Clk.

Milwaukee, Wis.—Building Inspector E. V. Koch estimates the cost of repairing the garbage crematory on Jones Island, at \$20,000.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

The Virginia Stove & Mfg. Co., Basic City, Va., is being organized, with a capital of \$30,000. The company has bought a foundry which has not been in operation for a number of years, and consists of buildings 75x200 and 54x220 ft., respectively. The company desires catalogues of foundry equipment and supplies, exclusive of boiler, engine and cupola, which are already installed. A. L. Russell, gen. mgr.

The Newport, Ky., Milling Co. is building a 15,000-bu. elevator and warehouse. A 15-h.p. gasoline engine will be installed.

The George Cutter Co., Union & Fulton Sts., Chicago Ill., has let contracts for a 1 and 2-story factory building, 80x200 ft. The company expects to use electric power and to be ready for additional metalworking machinery by the middle of April.

The Chattanooga Implement & Mfg. Co., East Chattanooga, Tenn., expects to erect a new moulding room, to be about 100x200 ft.

W. M. Bruce, Lawton, Okla. T., is preparing to erect at once a 50-ton smelter.

Geo. P. Webster, R. F. D. 2, Columbia, Tenn., is interested in a stock company which is to erect a 100-bbl. flour and 500-bu. corn mill in Mt. Pleasant, Tenn. The company is in the market for lumber siding and machinery.

G. A. Bozman & Co., Suffolk, Va., contemplate erecting a mill for the purpose of spinning cotton yarns, but plans are not yet fully developed.

The Chas. P. Biggin Co., 1829-39 Harlan St., Philadelphia, Pa., will erect a 2-story 35x100-ft. brick addition, which will be used principally for benchroom for workmen. A medium weight double punch, four or five drill presses, emery grinder and buffer, with the necessary pulleys, shafting, etc., will be required.

The Owensboro, Ky., Wagon Co. expects to build a new plant and to put in an engine of about 350 h.p. and boilers to correspond. W. A. Steele, Secy. & Mgr.

Sealed proposals will be received at the Bureau of Yards and Docks, Navy Dept., Washington, until Feb. 4, for making improvements to the 100-ton shears at the Navy Yard, League Island, Pa. Mordecai T. Endicott, Chief of Bureau.

The Long Island R. R. Co. has filed plans for a 75x450-ft. brick and steel electric repair shop to be located at Morris Park, N. Y. The estimated cost of the building is \$60,000, and it is said the machines will be operated by electric current from the power house at Long Island City.

The Iowa Brewing Co., Iowa City, Ia., will rebuild its recently burned plant, but the plans are still in the architects' hands.

The Greenbrier River Lumber Co., Marlinton, W. Va., intends to rebuild its recently burned plant, but plans have not yet been completed.

The Michigan Novelty Works, Kalamazoo, Mich., will erect a new plant, details of which are as yet unavailable.

The Stone Printing & Mfg. Co., Roanoke, Va., contemplates erecting a new 2-story factory building, about 150x100 ft. in size. In case the company decides to install its own power-generating plant, it may require about 50 or 75 h.p., either as a steam power plant, with a direct connected dynamo, a couple of gasoline engines or a turbine engine.

MISCELLANEOUS.

Montgomery, Ala.—Bids will be received Jan. 16 by R. S. Williams, City Treas., for furnishing city with Louisville and Portland cement.

Sacramento, Cal.—Frank D. Ryan, State Comr. of Pub. Wks., is stated to have issued a brief summary of the report of the Bd. of Engrs., employed by the State to prepare plans for the improvement of waterways of Sacramento and San Joaquin Rivers and for the reclamation of overflowed land; the cost of the proposed work is \$23,766,000.

Savannah, Ga.—Bids will be received by Col. Jas. B. Quinn, Corps Engrs., U. S. A., Savannah, for dredging in Darien Harbor and on Doboy Bar, Ga., as advertised in The Engineering Record.

Chicago, Ill.—The following the the bids opened on Jan. 4, by the Superv. Archt. Treasury Dept., Washington D. C., for a mail conveying system for the U. S. Post Office at Chicago: Link Belt Machine Co., Chicago, \$93,732; Webster Mfg. Co., Chicago, \$64,906; Lawson Stone Service Co., Boston, Mass., \$122,500; and Jeffreys Mfg. Co., Columbus, O., \$57,895.

Chicago, Ill.—Bids will be received by Col. O. H. Ernst, Corps Engrs., U. S. A., on Feb. 4, for dredging and constructing docks in Chicago River, Ill., as advertised in The Engineering Record.

Moline, Ill.—Bids will be received Jan. 10 by the Id. Local Improv., for constructing 1,461 ft. of 24, 36 and 48-in. storm drain, including necessary inlets, catch basins, and manholes. Henry G. Paddock, Secy.

Hutchinson, Kan.—The City Council is stated to have passed an ordinance authorizing the construction of the ditch to take care of the overflow waters in Cow creek and empty it into Arkansas River. The line has been surveyed by City Engr. Eibury; probable cost of work \$16,000 to \$20,000.

*New Orleans, La.—Jas. Stewart & Co., of Pittsburg, Pa., are stated to have secured the contract for the construction of freight sheds, ship docks and terminals at Chalmette for the New Orleans Terminal Co. (bids opened Dec. 28); contract price reported to be about \$2,500,000.

Local press reports state that bids will be received Jan. 10 by the State Bd. Engrs. at New Orleans for enlarging and strengthening about 2½ miles of Metairie levee, Fifth Louisiana Levee Dist., in East Carroll Parish; enlargement will comprise approximately 100,000 cu. yd. of earth. J. T. McClellan, Pres. Fifth Dist.

Springfield, Mass.—Bids will be received Jan. 19 by Col. Frank L. Phipps, Ord. Dept., U. S. A., for furnishing and installing a fuel oil plant at Springfield Armory, including 2 storage tanks for oil, an oil pump, necessary pipe, fittings and oil burners for connection with 31 furnaces, and a supply of extra burners.

*Boston, Mass.—Hiram A. Miller, Ch. Engr. Charles River Basin Comm., writes that the contract for building the Charles River dam and lock in Boston and Cambridge (bids opened Dec. 20) has been awarded to Holbrook, Cabot & Kollins, 6 Beacon St.; total of this bid was \$801,607. For list of detailed bids received for this work, see issue of The Engineering Record Dec. 31.

Camden, N. J.—Mayor Stackhouse on Dec. 28 signed the \$90,000 park bond issue.

West Point, N. Y.—Bids will be received by the Quartermaster, U. S. A., on Jan. 28, for the installation of a boiler and mechanical draft plant, as advertised in The Engineering Record.

New York, N. Y.—Bids were opened on Dec. 31 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of Dry Dock No. 4, of granite and concrete, to be constructed at the New York Navy Yard. The following figures submitted are for the work complete in accordance with the plans and specifications: John Peirce, 277 Bway., New York, \$885,000; Geo. B. Spearin, 17 Battery Pl., New York, \$773,292; The United Engr. & Contr. Co., 13 Park Row, New York, \$815,934; Buckley Realty Constr. Co., Times Bldg., New York, \$1,896,490; and The New York Continental Jewell Filtration Co., 15 Broad St., New York, \$829,880.

*Brooklyn, N. Y.—Wm. H. Jenks, 132 Pearl St., New York, is stated to have secured the contract for constructing the freight terminal and market at the foot of Baltic St., for the New York Dock Co.

Portland, Ore.—Bids are wanted Jan. 31 for stone for extension of jetty at mouth of Columbia River, Oregon and Washington. Maj. W. C. Langfitt, Corps Engrs., U. S. A.

Newport, R. I.—See "Paving and Roadmaking."

*Providence, R. I.—H. E. Wood, Secy. Dept. Pub. Wks., writes that Chas. M. Kelly, of Providence, has secured the contract for 6,000 bbls. of "Atlas" Portland cement (bids opened Dec. 19) at \$1.37 per bbl., and the H. R. Horton Co., of Providence, for 2,000 bbls. of natural cement at 98 cts. per bbl.

Norfolk, Va.—Capt. E. E. Winslow, Corps Engrs., U. S. A., writes that the following are the bids opened on Dec. 30, for dredging Appomattox River, Va.: W. N. Mays, Petersburg, Va., 38½ cts.; Leroy M. Lewis, Berkeley, Va., 53 cts., and Atlantic Dredging Co., Philadelphia, Pa., 37 cts.

Bremerton, Wash.—The lowest bid opened on Dec. 31 by the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for a 40-ton crane for the Puget Sound Navy Yard, is stated to have been submitted by the Cleveland Crane & Car Co., of Cleveland, O., for \$6,490.

Guanacavi, Durango, Mex.—The Guanacavi Tunnel Co. has been organized to drive a 12x8-ft. tunnel about 10,000 ft. long, under a ridge a short distance south of the important mines at this place. It is expected that this tunnel will cut a number of valuable veins of ore. The officers of the company are: President, Hilarrio Losoya, Guanacavi; treasurer, Wm. W. Flanagan, former president of the Southern Bank, New York; assistant treasurer, Federico Griese, Parral, Mex.; manager of the Parral branch of the U. S. Banking Co. The company's New York office is at 25 Broad St.

Toronto, Ont.—It is stated that bids will be received Jan. 26 by Fred. Gellinas, Secy. Bd. Pub. Wks., Ottawa, for constructing extension of breakwater on south side of Toronto Island.

Panama.—Bids will be received until Jan. 18, by the Isthmian Canal Comm. at Washington, D. C., (J. G. Walker, Chmn.), for delivering c. i. f. at either Colon or La Boca, an air brake equipment.

BUSINESS NOTES.

Tucker & Vinton, 156 Fifth Ave., New York, have nearly completed the power plant at Trionda, N. Y., which includes an Amberg reinforced concrete dam 25 ft. high and 250 ft. long between abutments, a brick and steel power house and an 8-ft. steel penstock enclosed in concrete, the whole job comprising about 7,000 yd. concrete. They have also about completed a highway bridge 54 ft. wide and 284 ft. long at Lerby, Ct., which includes three Melan arches of 72-ft. clear spans and has pile and gravel foundations constructed in open cofferdams. The construction of the concrete floors, coal pocket bottoms and sixteen hot wells in the Interurban Construction Co.'s 58th St. power house, and of the signal towers, compressor rooms and collision walls for the Rapid Transit Subway have just been completed and other similar contracts have been taken, besides about twenty contracts for patent Ransome system reinforced concrete vault lights in New York and vicinity.

According to the Allentown, Pa., "Morning Call" of Dec. 29, the stockholders of the Atlas Portland Cement Co. will meet Feb. 16 to vote on the recommendation of the board of directors to issue \$5,000,000 six per cent. bonds.

The D. W. Payne Controller & Engineering Co., New York City, recently organized, is to handle among other things, it is understood, the D. W. Payne engine governor. The members of the company are D. W. Payne and E. P. Hampson and W. A. Robinson, of New York.

The National Concrete Construction Co., Louisville, Ky., has been incorporated, with a capital of \$25,000, by J. B. Ohlischlager, Webster Gazlay and B. H. Henry.

The Milwaukee Bridge Co. completed its new plant and commenced operations about Sept. 1, 1903. Since that date it has turned out about 4,000 tons of bridge and structural material. The most important contracts have been two bascule bridges for the City of Milwaukee; two large bridges over the Kaw river at Kansas City; bridge over Minnesota River at St. Peter, Minn.; eight steel buildings for the St. Louis Smelting & Refining Co. at Collinsville Ill.; power plant for Portland, Ore. General Electric Co.; viaduct at Petoskey, Mich.; office building for North Western Nat'l Ins. Co., Milwaukee; and a number of railroad and highway bridges, steel buildings, etc., aggregating in value over \$500,000. It is now erecting a 240-ft. draw span and a 180-ft. fixed span at Grand Rapids, Mich.; a 250-ton bridge with concrete floor over C. & N. W. R. R. in Milwaukee, and now has under contract about 1,200 tons of railroad bridge work and many miscellaneous orders for bridge and structural material. A 100x130-ft. addition is being built for the shop, and there will be installed an additional 10-ton electric crane in main shop, and a 5-ton crane with runways for receiving yard.

The Pratt Elevator Safety Co., New York, has been incorporated, with a capital of \$50,000, by T. N. Motley, C. R. Pratt and H. C. Dayton, of New York.

The Allis-Chalmers Co. opened new sales offices in Philadelphia on Jan. 1, in the Land Title Bldg. The offices heretofore maintained by the electrical department of the company, the Bullock Electric Mfg. Co., in the North American Bldg., have been removed to the Land Title Bldg. where they have been consolidated with those of the parent company. The new offices are under the charge of W. A. Wood, who will look after each of the interests of the company. These interests include the power department, the electrical department, pumping engine department, hydraulic department, saw mill machinery department, flour mill machinery department, and others which produce rock crushing machinery, cement making machinery, wood preserving machines and plants, mine hoists and machinery of all other kinds for mining and recovering gold, silver, copper and other metals.

The General Contracting & Engineering Co., 1 Exchange Pl., Jersey City, N. J., has been incorporated, with a capital of \$100,000, to construct bridges, piers, docks and to operate mines, build canals, wells, tunnels, etc. The incorporators are Wm. O. Sprigg, Jas. P. Northrop and Howard C. Griffiths.

The Philadelphia Iron Works, 18th St. and Penna. Ave., Philadelphia, have let contracts to the Belmont Iron Works for an addition to their erecting shop, electric cranes to the Niles-Bement-Pond Co. and for riveters to S. S. Caskey, of Philadelphia. They contemplate making further improvements the coming season.

Frank B. Gilbreth, general contractor, 34 West 26th St., New York, has exclusive of work handled by his Baltimore office, the following work in progress: For the International Paper Co., Berlin, N. H., three concrete dams and a crib dam aggregating about 20,000 yds. of rock excavation, 16,000 yds. of concrete, 500,000 brick, 300 tons steel, together with the placing of several large steel penstocks, water-wheels, generators and other machinery; approximate cost, \$350,000. Two mercantile buildings at Rumford Falls, Me., for the Rumford Falls Power Co. A 4-story mill building for Walworth Mfg. Co., So. Boston, Mass. Large concrete foundation and large pumping plant for the Boston Molasses Co., So. Boston, Mass. House and stable for E. J. Bliss, Commonwealth Ave., Boston; approximate cost, \$80,000. Power house and machinery foundation at Lyons, N. Y., for the Syracuse, Rochester & Eastern R. R. Masonry dam across the Saranac River at Cadysville, N. Y.; this dam is 50 ft. high, contains about 10,000 cu. yds. of concrete. Sargent Gymnasium at Harvard College, Cambridge, Mass. Automobile Garage, 432 Beacon St., Boston. Seven-story Dormitory at Cambridge, Mass. Fireproof residence for C. B. Alexander, 58th Street, near cor. 5th Ave., N. Y. City; total cost, approximately \$600,000; steel tonnage 550. Power house for the City of East Orange, N. J. Village of forty odd frame dwellings, power house and some mill construction at Pierceland, N. Y., for the International Paper Co. Factory for the Kirsheed Mfg. Co., at Brooklyn, N. Y. Brick 80x500-ft. factory for the Auburn, N. Y., Hame Co.

PROPOSALS OPEN.

For proposals see pages 24, 27, 28.

Bids Close.	WATER WORKS.	See Eng. Record.
Jan. 10.	Pipe, Panama.	Dec. 3
Jan. 11.	Hydrants, etc., New York, N. Y.	Jan. 7
Jan. 11.	Pipe, etc., Brooklyn, N. Y.	Dec. 31
Jan. 12.	Newcastle, Neb.	Dec. 31
Jan. 14.	Pumping engine, Kansas City, Mo.	Dec. 17
Jan. 15.	Louisburg, N. C.	Dec. 31
Jan. 15.	Improvements, Iowa Falls, Ia.	Dec. 17
Jan. 19.	San Diego, Cal.	Jan. 7
Jan. 21.	Newark, N. J.	Jan. 7
Jan. 23.	Louisburg, N. C.	Adv. Jan. 7
Jan. 24.	Well, Dallas, Tex.	Jan. 7
Jan. 25.	Leadwood, S. D.	Dec. 17
Adv. Dec. 17.		
Jan. 28.	Phoenix, Ariz.	Jan. 7
Jan. 31.	Mains, New Orleans, La.	Nov. 26
Adv. Nov. 26 to Dec. 24.		
Feb. 1.	Princeton, Ky.	Dec. 10
Feb. 1.	Pipe, San Francisco, Cal.	Dec. 3
Feb. 10.	Bishop, Cal.	Dec. 10
Adv. Dec. 10 to 24.		
Mar. 1.	Smith's Grove, Ky.	Jan. 7
Apr. 1.	Irrig., Usk, Wash.	Dec. 24

SEWERAGE AND SEWAGE DISPOSAL.

Jan. 10.	Monticello, Ind.	Jan. 7
Jan. 10.	Marion, S. C.	Jan. 7
Jan. 11.	Houston, Tex.	Jan. 7
Jan. 12.	Bloomington, Ill.	Jan. 7
Jan. 15.	Louisburg, N. C.	Dec. 31
Jan. 16.	Momence, Ill.	Jan. 7
Jan. 16.	Amarillo, Tex.	Dec. 24
Jan. 17.	Jewett City, Conn.	Jan. 7
Jan. 18.	Brooklyn, N. Y.	Jan. 7
Jan. 19.	San Diego, Cal.	Jan. 7
Jan. 19.	Iola, Kan.	Dec. 31
Jan. 23.	Louisburg, N. C.	Adv. Jan. 7
Jan. 26.	Coldwater, Mich.	Jan. 7
Jan. 31.	New Orleans, La.	Nov. 26
Adv. Nov. 26 to Jan. 7.		
Feb. 1.	Cresco, Ia.	Dec. 31
Feb. 7.	Los Angeles, Cal.	Jan. 7
Feb. 10.	Bishop, Cal.	Dec. 10
Adv. Dec. 10 to 24.		

BRIDGES.

Jan. 10.	Harrisburg, Pa.	Dec. 31
Jan. 11.	Spartanburg, S. C.	Dec. 24
Adv. Dec. 24, 31.		
Jan. 11.	Junction, Mont.	Dec. 3
Jan. 12.	Hoopeston, Ill.	Jan. 7
Jan. 14.	Oshkosh, Wis.	Dec. 24
Adv. Dec. 24 to Jan. 7.		
Jan. 19.	Toledo, O.	Dec. 31
Feb. 6.	Santa Barbara, Cal.	Jan. 7
Feb. 14.	Napa, Cal.	Dec. 31

PAVING AND ROADMAKING.

Jan. 9.	Newark, N. J.	Jan. 7
Jan. 10.	Jeffersonville, Ind.	Dec. 31
Jan. 11.	Glensville, O.	Dec. 17
Jan. 12.	Bloomfield, Ind.	Dec. 31
Jan. 13.	Omaha, Neb.	Dec. 10
Jan. 14.	Orrville, O.	Dec. 31
Jan. 16.	Louisville, Ky.	Jan. 7
Jan. 16.	Atlantic City, N. J.	Dec. 31
(4 Prop.)		Adv. Dec. 31
Jan. 16.	Knox, Ind.	Dec. 24
Jan. 17.	New York, N. Y.	Jan. 7
Jan. 17.	Collingswood, N. J.	Jan. 7
Jan. 18.	Cincinnati, O.	Dec. 31
Jan. 21.	Sussex, N. J.	Jan. 7
Jan. 21.	Emeryville, Cal.	Jan. 7
Jan. 31.	Ebensburg, Pa.	Jan. 7

*Items marked thus give the names of parties awarded contracts.

Feb. 7.	Rensselaer, Ind.	Dec. 31
Feb. 14.	Napa, Cal.	Dec. 31

POWER, GAS AND ELECTRICITY.

Jan. 10.	Washington, D. C.	Dec. 31
Jan. 10.	Spring Lake, N. J.	Dec. 24
Adv. Dec. 24, 31.		
Jan. 11.	New York, N. Y.	Jan. 7
Jan. 15.	Humble, Tex.	Dec. 31
Jan. 16.	Governor's Island, N. Y.	Jan. 7
Jan. 16.	Fullerton, Cal.	Dec. 17
Jan. 17.	Washington, D. C.	Jan. 7
Jan. 17.	Chicago, Ill.	Dec. 24
Jan. 21.	Washington, D. C.	Jan. 7
Jan. 21.	Pt. Snelling, Minn.	Dec. 31
Jan. 24.	Riverside, Cal.	Jan. 7
Jan. 24.	Newport, R. I.	Dec. 31
Jan. 28.	Pt. D. A. Russell, Wyo.	Dec. 31
Adv. Dec. 31 to Jan. 7.		
Jan. 31.	Ft. Walla Walla, Wash.	Jan. 7
Feb. 15.	Chicago, Ill.	Dec. 24

BUILDINGS.

Jan. 10.	Greenhouse, National Military Home, O.	Jan. 7
Jan. 10.	School, Birmingham, Ala.	Jan. 7
Jan. 10.	Bus. Bldg., Wheeling, W. Va.	Dec. 31
Jan. 10.	P. O. Bldg., New Castle, Pa.	Dec. 3
Jan. 10.	Plumbing fixtures, Panama.	Dec. 3
Jan. 12.	Hospital, Boston, Mass.	Jan. 7
Jan. 12.	Pub. Bldg., Supplies, New York, N. Y.	Dec. 31
Jan. 12.	Stable, Brooklyn, N. Y.	Dec. 31
Jan. 14.	School, Rockland, Mich.	Dec. 31
Jan. 14.	School, Paton, Ia.	Dec. 24
Jan. 15.	Church, St. Louis, Mo.	Jan. 7
Jan. 16.	Schools, Brooklyn, N. Y.	Jan. 7
Jan. 16.	Armory, Louisville, Ky.	Jan. 7
Jan. 16.	School, New York, N. Y.	Jan. 7
Jan. 16.	School, Long Island City, L. I., N. Y.	Jan. 7
Jan. 16.	School, New Brighton, S. I., N. Y.	Jan. 7
Jan. 16.	School, Lewiston, N. Y.	Jan. 7
Jan. 16.	Hospital, Ft. Screven, Ga.	Dec. 24
Adv. Dec. 24 to Jan. 7.		
Jan. 17.	Engine House, New Haven, Conn.	Jan. 7
Jan. 18.	Court House, Camden, S. C.	Jan. 7
Jan. 18.	Guard House, Ft. Thomas, Ky.	Dec. 31
Jan. 18.	Htg. P. O. Bldg., Yankton, S. D.	Dec. 24
Jan. 19.	Pub. Bldgs., Ft. Meade, S. D.	Jan. 7
Jan. 19.	Post Bldg., Des Moines, Ia.	Dec. 24
Jan. 19.	P. O. Bldg., Fresno, Cal.	Dec. 3
Adv. Dec. 3, 10.		
Jan. 20.	Pub. Bldg., Ft. Logan H. Roots, Ark.	Dec. 24
Jan. 20.	Post Bldg., Governor's Island, N. Y.	Dec. 24
Jan. 23.	Church, Waupaca, Wis.	Jan. 7
Jan. 23.	School, Cincinnati, O.	Jan. 7
Jan. 24.	School, Galena, Ill.	Jan. 7
Jan. 25.	P. O. Bldg., Washington, Pa.	Dec. 3
Adv. Dec. 3, 10.		
Jan. 26.	School, Ft. Mojave, Ariz.	Jan. 7
Jan. 26.	Moving Univ. Bldg., Iowa City, Ia.	Adv. Jan. 7
Jan. 28.	Police Station, Newburg Heights, O.	Dec. 31
Jan. 30.	School, Webster, N. D.	Jan. 7
Jan. 30.	P. O. Bldg., Dekalb, Ill.	Jan. 7
Jan. 31.	Pub. Bldg., Ft. Moultrie, S. C.	Jan. 7
Jan. 31.	P. O. Bldg., Albert Lea, Minn.	Dec. 10
Jan. 31.	Public Bldg., Des Moines, Ia.	Dec. 3
Feb. 1.	P. O. Bldg., Ogden, Utah.	Dec. 31
Adv. Dec. 31.		
Feb. 1.	Church, Zanesville, O.	Dec. 31
Feb. 1.	Court House, Goshen, Ind.	Dec. 31
Feb. 1.	Court House, Elkhart, Ind.	Dec. 3
Feb. 7.	P. O. Bldg., Nevada, Mo.	Dec. 31
Feb. 9.	P. O. Bldg., Natchez, Miss.	Jan. 7
Adv. Jan. 7.		
Feb. 21.	P. O. Bldg., Westchester, Pa.	Dec. 31
Adv. Dec. 31 to Jan. 7.		
Feb. 1.	Hospital, Albany, N. Y.	Dec. 24
Mar. 6.	Court House, Sardis, Miss.	Dec. 17
Apr. 5.	Court House plans, New Orleans, La.	Dec. 3

MISCELLANEOUS.

Jan. 9.	Steel Shed, Stockton, Cal.	Dec. 31
Jan. 9.	Dredging, Norfolk, Va.	Dec. 24
Adv. Dec. 24, 31.		
Jan. 9.	Wagon shed, Ft. Rosecrans, Cal.	Adv. Dec. 10 to 24
Jan. 7.		Dec. 10
Jan. 9.	Tunnel, Casper, Wyo.	Nov. 26
Adv. Nov. 26 to Dec. 31.		
Jan. 10.	Grain, Moline, Ill.	Jan. 7
Jan. 10.	Levee, New Orleans, La.	Jan. 7
Jan. 10.	Cement, Roswell, N. M.	Dec. 24
Adv. Dec. 24 to Jan. 7.		
Jan. 14.	Dredging, Panama, I.	Dec. 31
Jan. 14.	Dike, San Francisco, Cal.	Dec. 10
Jan. 16.	Cement, Montgomery, Ala.	Jan. 7
Jan. 16.	Garb. Disp., Lakewood, O.	Jan. 7
Jan. 16.	Dynamite, etc., Panama.	Dec. 17
Jan. 17.	Supplies, Washington, D. C.	Dec. 31
Jan. 18.	Plumbing material, etc., Panama.	Dec. 24
Jan. 19.	El. Ry. work, Brooklyn, N. Y.	Jan. 7
Jan. 19.	Fuel Oil Plant, Springfield, Mass.	Jan. 7
Jan. 20.	R. R. work, Guthrie, Okla.	Ter. Dec. 17
Jan. 23.	Dredging, New Orleans, La.	Dec. 3
Jan. 24.	Piles, Panama	Dec. 31
Jan. 26.	Breakwater, Toronto, Ont.	Jan. 7
Jan. 28.	Draft plant, West Point, N. Y.	Adv. Jan. 7
Jan. 31.	Jetty, Fort Randolph, O.	Jan. 7
Feb. 1.	R. R. work, Sonoma, Cal.	Dec. 24
Feb. 3.	Dredging, Savannah, Ga.	Jan. 7
Adv. Jan. 7.		
Feb. 4.	Industrial Plant, Philadelphia, Pa.	Jan. 7
Feb. 4.	Dredging, Chicago, Ill.	Jan. 7
Adv. Jan. 7.		
Feb. 8.	Dam, etc., Phoenix, Ariz.	Dec. 3
Adv. Dec. 3 to 24.		
Feb. 15.	Dredging, Chicago, Ill.	Dec. 24
Mar. 31.	El. Ry., Shanghai, China.	Oct. 22
—	Ore Dock, Duluth, Minn.	Nov. 26
—	Quarry stripping, McDermott, O.	Adv. Nov. 19 to Dec. 17
—	R. R. work, Selma, Ala.	Dec. 24